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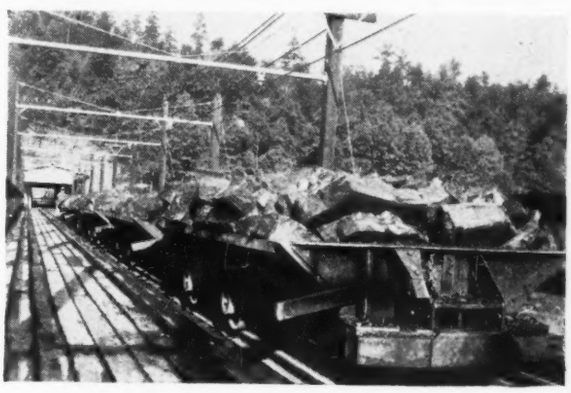

Coal en route to track hopper at Stearns Blue Heron plant

- **How would** you like to save from $90,000 to $160,000 per mile of main opening? Such initial savings in mining operations are possible if you know what cover to support and how, declares Prof. Bucky in the second article in his current series on artificial roof support. This instalment, scheduled for publication next month, will deal with entry and heading roof-support problems in pitching seams.

- **Rubber-tired** haulage makes its initial Indiana bow in the Wick mine of Ingle Coal Co.—an organization long noted for its furtherance of mechanization. This installation, the fourth of its kind in the United States, serves two loading machines which account for approximately 80 per cent of the mine output. Ivan Given tells the complete story in the article beginning on page 29.

- **Chicago** plays host to the annual convention of the National Safety Council and the joint meeting of the Coal Division of A.I.M.E. and the Fuels Division of A.S.M.E. this month. The programs forecast significant contributions to greater mine safety, advanced operating practices and improved fuel technology. As usual, Coal Age editors will be on the job to highspot these meetings for our November issue.

- **Rock dust** in bags which keep it free from contamination until released by the air pressure preceding an explosion is the latest development in preventing major disasters. John E. Jones, safety engineer, Old Ben Coal Corporation, who was responsible for most of the basic features of present rock-dusting methods, also is father of the new system. How it operates is told on page 40.

- **A textbook** on modern mining methods as practiced in the State of Indiana summarizes the editorial content of our December issue. In gathering material for this Eighteenth Annual Model-Mining Number, Coal Age editors and staff photographers visited nearly fifty different properties. All types of operations—both strip and deep mining—were covered, so that the issue will present a comprehensive, well-rounded picture of Hoosier activities.

- **New vistas** in the application of chemistry to coal problems were opened at the meeting of the fuel and gas division of the American Chemical Society at Milwaukee last month. While some may disclose goals still far distant, others have a more immediate significance. But near or far in practical attainment, these new paths are all outlined in the staff report which starts on page 76.

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STREAMLINE

COAL AGE

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DEVOTED TO THE OPERATING, TECHNICAL AND BUSINESS PROBLEMS OF THE COAL-MINING INDUSTRY

SYDNEY A. HALE, *Editor*

October, 1938

Big Pumps and Fans

BIG PUMPS and fans are needed for capacity, but money is wasted if concurrently the capacity of the carrying channels for the fluids moved is not provided. This would seem too obvious for expression were it not for the unfortunate frequency with which mine foremen urge that what they need is a bigger pump or fan when what is really required is more or larger pipe or more headings. Where such bigger units can be supplied from stock, the desires of the foreman too often are satisfied at considerable waste of power. In some companies, however, his requisition must be passed upon by the mining engineer, who refuses to have it filled unless means adequate to handle the fluids are provided. Sometimes, however, the emergency or the life of the job does not permit of such general reconstruction.

Stays Put

IMPRESSIONS FADE, orders are disobeyed, injunctions forgotten, but safety mechanisms quite generally endure. True, guards may be torn down or lost; all equipment ultimately deteriorates; places may be abandoned and their mechanisms may have to be replaced, but, on the whole, mechanism "stays put." It has no free will, no brainstorms, no trouble at home, no distractions; it is calculated to repeat its performance hour by hour. It needs inspection, but no inspirational talks, to keep it in operation. If "the will to safety" is any good at all, it is because it has an almost mechanical action known as habit to make it repetitive and dependable.

As "safety is that way," cast around always for a safety contrivance that does not need winding up with a safety talk. Make the mine foolproof as can be, forestall all possible accidents with every suitable safeguard, and then follow with the formation of safety habits and viewpoints. Permanence in safety, like durability in machines, is the goal. After every accident, the question should be: "Could it have been avoided by redesign of equipment or practice?" Accidents should be visualized even before their occurrence, and the dreamt casualty followed by similar preventive action.

George Can't Do It

MODERN BUSINESS is so interwoven with community and national life that industrial promotion of proper public relations takes rank with production and distribution as a major executive job. Why this is so and why the job cannot be safely ignored are set forth in the special Public-Relations insert which begins on page 43 of this issue of *Coal Age*. This insert is the first of a continuing series of articles on this important subject.

Two aspects of such a program, touched upon briefly in this initial presentation, will bear constant reiteration. One is the fact that promotion of sound public relations can be successful only to the extent that the activities and attitudes of a company or an industry merit it. A public-relations campaign is no substitute for policies not in keeping with modern trends or socially

desirable; neither can it long cover up such policies. Unless a company or an industry is prepared to live up to its public professions, those professions had better never be made.

The second aspect which should be driven home is that the promotion of a public-relations program must be stamped with the personality of its sponsor. Too many executives seem to believe that the job can be done with canned material. George can dig up and assemble basic material; George can even counsel how such data may be dramatized. But, if maximum effectiveness is to be attained, that material must be converted and interpreted by its users in terms of its application to their respective and specific situations. George can't do it.

Refuse-Dump Fires

British studies on spoil-bank fires have resulted in several recommendations aimed at reducing their occurrence. Among these are: Packing of refuse to make it impervious to air; reduction to a minimum of carbonaceous material in the dump; separate deposition of coarse and fine material; construction of flat-top piles so that lumps cannot roll to the bottom of the fill and allow air access under the pile; dumping in stages with intermediate consolidation; packing in old underground workings all carbonaceous material originating within the mine; rock-dusting or clay-grouting of burning dumps through pipes driven down into the refuse; crushing and re-treatment of washery refuse to recover coal values and increase the ash content of material sent to the dump; starting new dumps so devised as to be less subject to firing.

Minus ½-in. washery rejects containing 70 per cent of ash spread over a seriously active refuse-dump fire near Dewsbury, England, and consolidated with a roller are said to have subdued that conflagration. A method, adopted with success at a mine in the United States and worthy of imitation, has been to convey refuse to the dump in an auto truck. In this way the material is spread in shallow masses, rolled by the broad tires of the truck into a continuous consolidated stratum so as to make the entry of air difficult and to prevent segregation. Cars running on tracks do not give the local pressure needed for the effective consolidation of a refuse dump.

Sane and Persuasive

Current reports indicate a widespread acceptance and use of a folder entitled "Why," published last month by the National Coal Association as the opening gun in the second phase of its promotional program to recover lost markets. The objective of this second phase, as stated by J. D. Battle, executive secretary, is "to acquaint industry in general with conditions in the hope that they may get the broad picture and lend their aid towards a recovery of the coal market and a reemployment of labor and capital in the industry."

The folder in question admirably fulfills the educational function outlined. While addressed primarily to those who would sell the bituminous coal industry, reciprocity is not invoked as a special privilege. The text frankly recognizes that coal has no right to expect or solicit favors in a fair competitive battle. What it asks is support in removing obstacles to such competition by the elimination of practices and legislation which foster unfair competition.

Such competition, of course, is waged at the immediate expense of the mining industry; ultimately, however, it adversely affects all directly or indirectly dependent upon that industry for all or a part of their business or livelihood. Coal has a real story to tell on that score. The National Coal Association is telling that story effectively—on a basis of self-interest, to be sure, but with full appreciation of the broader national picture of which fuel is a part. Nowhere has the story been told more succinctly and persuasively than in "Why."

RUBBER-TIRED HAULAGE

+ Latest Mechanization Development

At Ingle Coal's Wick Mine

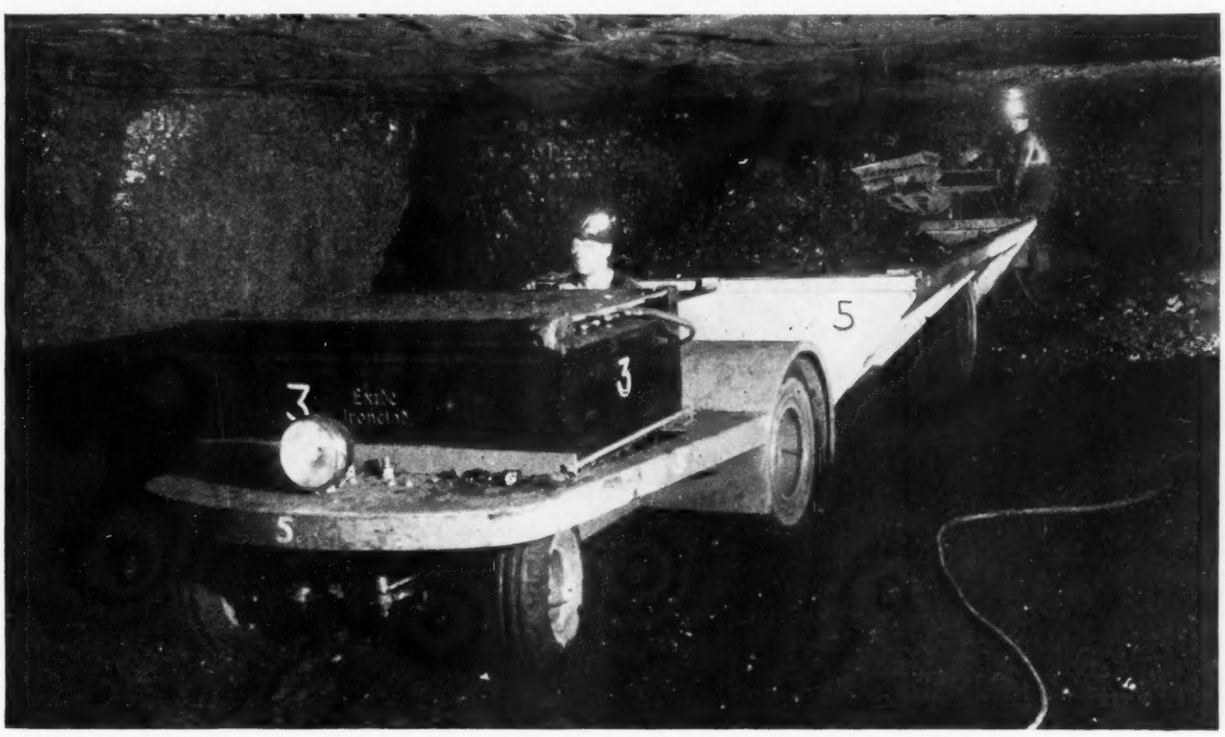
By IVAN A. GIVEN
Associate Editor, Coal Age

SHIPPING an average of 1,000 tons of cleaned and prepared coal from its Wick mine, the Ingle Coal Co., Oakland City, Ind., obtains approximately 80 per cent of this total from two loading machines served by rubber-tired-battery-powered haulage units. The remainder is produced by two "syndicates," one on each shift, engaged in driving entries with a third loading machine, mine cars and locomotive.

The Ingle name has long been associated with the mechanization of coal loading, and many of today's standard practices were pioneered by the Ingle organization, headed by David Ingle, Sr., also general manager of the Buckskin Coal Corporation, and including W. D. Ingle, vice-president, and W. D. Ingle, Jr., superintendent, Ingle Coal Co., and David Ingle, Jr., superintendent of the Buckskin mine. Consequently, the Wick mine has been on a full mechanical-loading basis since it was opened in 1928, and now becomes the first Indiana operation and the fourth in the United States to adopt battery-tractor haulage behind loading machines.

Wick mine was opened to recover the Indiana Fifth Vein, ranging from 5½ to 7 ft. in thickness and averaging 6 ft. Average thickness of the overburden is 140 ft. Much of the acreage lies in the Patoka River Valley; as a result, the thickness of the solid material in the top sometimes is as low as 10 ft., the remainder consisting of gravel and wash. Where the solid top thins, of course, mining is impossible, and consequently the tonnage which may be obtained from a territory frequently is governed by variations in the thickness of the solid material. A heavy rash which comes in in some localities is another factor limiting mining. Directly over the seam is 8 to 10 ft. of black slate

Wick battery-tractor haulage unit behind a loading machine in a narrow place.



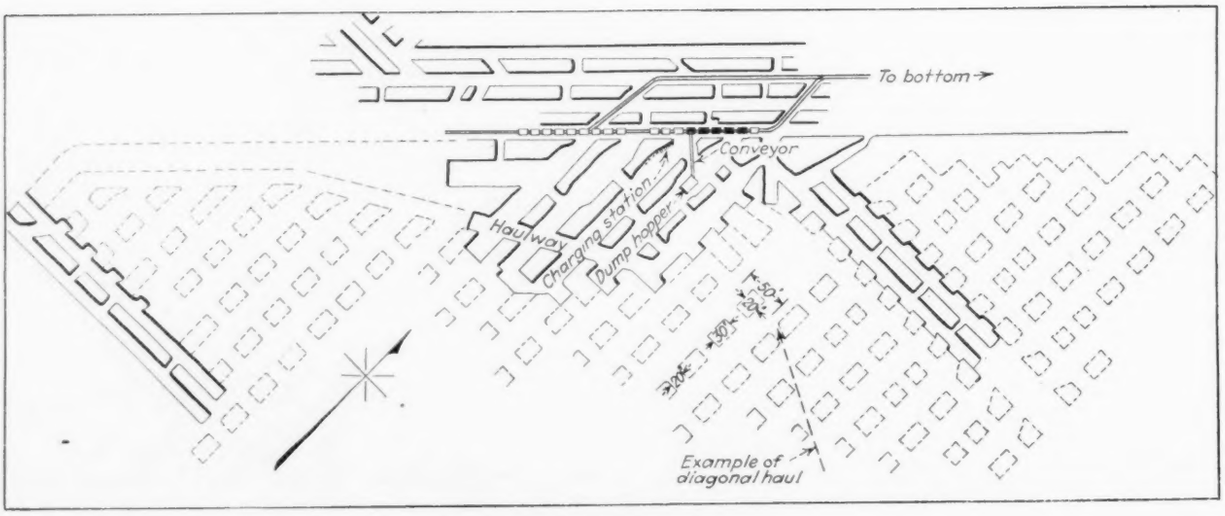


Fig. 1—Checkerboard working plan used with rubber-tired haulage at Wick mine. Also shown are the locations of the dump hopper and car-loading conveyor, as well as the method of bringing in trips of mine cars for loading.

filled with concretions, or boulders. Under the seam is 3 to 4 ft. of fireclay followed by a sandy shale.

The main opening at Wick is a 6½x16-ft. slope 261 ft. long. Inclination of the slope is 18 deg., and it is fitted with a track and hoist for handling equipment and materials, as well as 36-in. belt conveyor 508 ft. long between pulley centers for bringing out the coal. This slope is supplemented by a separate downcast air shaft for ventilation. Coal is transported in A.C.F. and Sanford-Day drop-bottom cars, which dump into an 80-ton bin at the foot of the slope. From this bin the coal is fed onto the belt by an adjustable-stroke reciprocating plate feeder driven by a 5-hp. motor. Four feeding speeds are available. The belt is driven by a 100-hp. motor, although the running demand fully loaded is only 35 to 40 hp. This low power requirement and a substantial reduction in labor cost were the major factors in the choice of a slope rather than a shaft.

Headings on 32-Ft. Centers

Main entries at Wick consist of four headings 15 ft. wide on 32-ft. centers. These major openings are extended by syndicates consisting of four men who are supplied with a loading machine, cutting machine, drill and locomotive. Each syndicate normally takes one cut per seven-hour shift out of each of the four headings, plus any crosscuts and other openings necessary. Syndicate output consequently averages 100 tons of cleaned coal or 125 tons of mine-run per shift. A Joy 7BU loading machine is employed, along with a Jeffrey 35BB shortwall cutter with 7-ft. bar, Dooley Bros. drill with Hardsoeg augers and a 6-ton Jeffrey cable-reel locomotive.

Battery-tractor operation began in May of this year at Wick mine in the section shown in Fig. 1. Equipment in this section consists of two Joy 7BU loading machines, two Jeffrey 35BB cutters with 7-ft. bars, two Joy T-20 caterpillar transfer trucks for transporting the cutters from place to place, two Dooley Bros. post-mounted electric coal drills with Hardsoeg augers and tapered mole-foot bits, five Baker-Raulang tractors powered by 24-cell (27 plates per cell) Exide-Ironclad batteries and pulling 4-ton (mechanically loaded) Sanford-Day drop-bottom trail cars, one Barber-Greene demountable steel dump hopper on which is suspended a 10-ft.-long chain-and-flight feeder, and a Barber-Greene car-loading conveyor consisting of a 30-in.-wide belt on a 60-ft.-long conveyer frame set on an inclination of 16 deg. 10 min. As shown in Fig. 1, the car-loading conveyor comes out from the hopper on an angle of 45 deg., which accounts for its somewhat longer-than-usual length. In future installations the conveyor will be set in line with the hopper or on an angle of 90 deg.

The Wick installation was made under the supervision of James H. Fletcher, consulting engineer, who developed the idea of using battery-powered rubber-tired haulage equipment. Loading machines, cutters, drills, cars, etc., already were on hand and, as battery locomotives already were in use for gathering coal, batteries for the new tractors were made by splitting the locomotive batteries in two. The major new expenditures necessary therefore were as follows: five tractors, $10,750; five trail cars, $3,410; dump hopper, feeder and conveyor, $2,000; two cutting-machine transfer trucks, $4,440; 30-kw. battery-charging generator, $1,200.

The pit for the dump hopper was made by outlining it with vertical cuts with an Oldroyd cutter, then shooting the material and loading it out with a loading machine. Cost of digging the pit, preparing the loading station over the tracks and installing hopper, feeder and conveyor was close to $800. Changes in track layout to permit loading pit cars in trips cost about $100, bringing the total expenditure to nearly $23,000. With the experience gained in digging the first pit, however, it is expected that the cost of subsequent installations will be materially less.

80,000 to 90,000 Tons Forecast

Production from the present set-up, barring unforeseen occurrences of bad top, is expected to be about 80,000 to 90,000 tons of shipped coal. Future set-ups, it is expected, will yield about 100,000 tons of coal each with a maximum round-trip tractor haul of 2,100 to 2,300 ft. The present section, it is expected, will be worked out by the spring of 1939.

As indicated in Fig. 1, the working section in which the rubber-tired equipment operates lies between two old room entries, with the dump hopper near the main entry, as shown. Mining will be carried to the east and south until roof conditions make it necessary to call a halt. Extraction is based on the use of a

"checkerboard" system, adopted to provide the maximum number of working places in a given area and also make the haulage as flexible as possible. Under this system the rooms are driven 30 ft. wide on 50-ft. centers, leaving 20x30-ft. pillars.

These pillars are staggered so that a solid pillar is opposite each crosscut, or at least so that the end of one pillar is in line with the end of the other across the place. Thus, long stretches of roof are not left without supports, as would be the case if crosscuts were in line with one another. Staggering the pillars also makes it possible to establish diagonal tractor-haulage roads, as indicated in the figure, thus shortening the distance from face to dump—an important consideration not only from the standpoint of production but also in preserving battery strength throughout the shift.

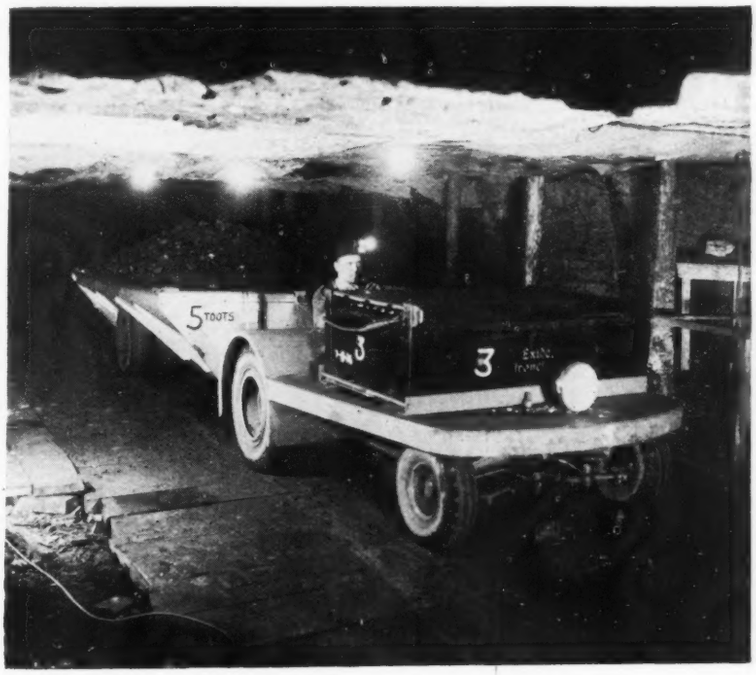
Make-Up of Section Crew

Equipment in the rubber-tire section at Wick is operated by four loading-machine men, four cutters, four drillers, four tractor drivers (the fifth machine is held in reserve until the haul exceeds about 800 ft. each way), two men overseeing dumping operations and car loading, one electrician and two main-line motormen, in addition to one section boss and the mine foreman, the superintendent and the mining engineer, who devote most of their time to this section. This crew delivers 900 to 1,000 tons of mine-run to the slope bottom every seven hours, representing 720 to 800 tons of cleaned and prepared coal ready for shipment. Maximum production up to the time this article was prepared was 207 cars per shift, representing about 1,035 tons of mine-run or 830 tons of prepared coal. The average in July was 187 cars, representing 935 tons of mine-run or 750 tons of prepared coal.

After the coal is loaded in a place the face is marked off by the mining engineer and then is undercut about 6½ ft. deep. As noted above, caterpillar-type transfer trucks are employed to move the cutting machines around from place to place—a matter of only a minute or two with this equipment after the machine is loaded up.

Natural conditions at Wick mine offer difficult cutting and shooting problems. Sulphur balls and boulders in the bottom where the undercut is made resulted in rapid wear and frequent breakage of the standard bit sharpened in the conventional roller sharpener and given the conventional heat-treating. The runners often had to set as many as 700 bits per shift and the sharpener was kept going two shifts to supply bits for one working shift. And the tendency of machine runners to stretch the time between bit replacements frequently resulted in cutting with dull and broken bits, increasing power consumption and wear and tear on the machine.

In view of this condition, the Wick management conducted an extensive investigation of patented bits and chains, finally adopting the Cincinnati Duplex chain and bit and installing a Duplex bit-making machine for cutting double-ended bits from bar stock. This machine was installed in the substation and the attendant cuts the mine requirements in his spare time. Bit cost per ton was reduced, tonnage cut per machine was increased, loading machines were kept in coal without cutting-machine overtime, the quality of the bugdust was



Spotting a trailer over the dump hopper

Loading one of a trip of five-ton mine cars in Wick mine

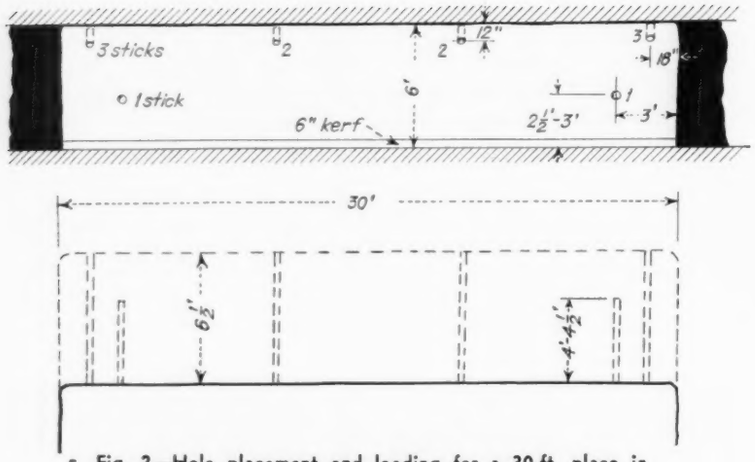


Fig. 2—Hole placement and loading for a 30-ft. place in Wick mine. This plan probably will apply in the majority of places, with variations to meet special conditions.

improved and machine maintenance was reduced. From the standpoint of power consumption, tests showed 0.59 kw.-hr. per ton with the standard chain and bits and 0.395 with the Duplex chain and bits. Feed speed was 15 in. per minute with the standard chain and 17.2 in. per minute with the Duplex equipment.

Drilling follows undercutting at Wick. Four horizontal sulphur-bearing strata at varying heights and the frequency with which boulders penetrate as much as 24 in. down into the coal from the roof complicate this problem. Consequently, shooting methods in the 30-ft.-wide places have been the subject of considerable investigation. As a result, it is expected that the plan shown in Fig. 2 will be adopted, subject to modifications to meet special conditions. This plan is based on the use of six holes in a 30-ft. place. Four holes are drilled in the top as shown, with two additional short holes in the bottom to give a snubbing effect. Hole diameter is 2 in., and the drillers also bugdust the kerf and load the holes with Red H F permissible powder, running about 122 1¾x6-in. sticks per 50-lb. box. Twelve sticks normally are required to shoot a 30-ft. place yielding about 40 tons of coal. Shots are fired after the working shift, using fuse and caps. Drillers are supplied with small rubber-tired trucks for convenience in transporting their equipment.

After the place is shot down it is ready for loading on the next working shift. Timbermen are not included in the regular crew listed above, as it is the intention to have any requirements placed by the night crew at the mine. Supplies, including timbers, are hauled in to the working places in the trail cars.

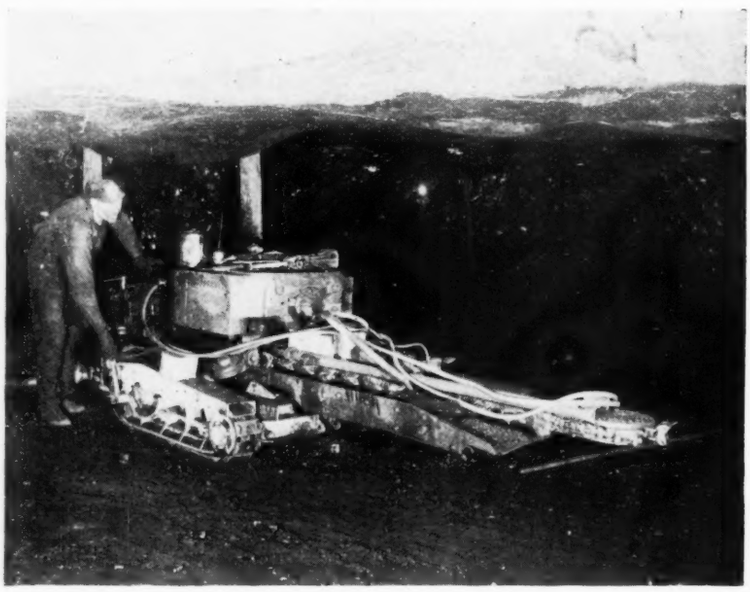
Loading machines at the present time are served by two tractor-haulage units each, these units following each other around from the machine to the dump. This condition will obtain until the round-trip haul reaches a maximum of about 1,600 ft., whereupon the fifth tractor will be placed in service and will alternate from one loading machine to the other. With five units, it is expected that the maximum round-trip haul can be extended to 2,100 to 2,300 ft. without loss of output.

The trail cars behind the tractors dump into the steel pit hopper noted above, from which the coal is fed onto the mine-car loading belt to begin the final stage of its trip to the slope bottom, 2,000 ft. away. Over this part of the cycle the coal is handled by one 8-ton Goodman and one 10-ton General Electric locomotives, each handling trips of eight cars. Nominal car capacity is 5 tons of mine-run coal. Cars are headed in from the slope bottom past the car-loading station and through a 45 to come in behind the previous trip, as indicated in Fig. 1. Normally, one locomotive is able to make a trip to the bottom and back before the other trip is loaded. The conveyor and feeder are equipped with pushbutton controls for starting and stopping while the trip is being pulled ahead by the locomotive to place an empty car under the loading conveyor.

Under the old system of using track and locomotives behind loading machines, a total of 86 mine cars were in use. Now, sixteen mine cars serve the rubber-tire section, while five serve the entry-driving syndicate.

In addition to other results, the installation of rubber-tired haulage at Wick mine has been attended by a substantial drop in power demand in spite of the fact that battery locomotives previously were used for most of the gathering load. The present average demand for the entire operation, including top works, averages 425 kw., compared with 700 kw. before the rubber-tired equipment was installed. Most of the drop is credited to the use of the new system. A marked drop in the use of locomotive sand was another by-product of the revision in transportation methods.

Cutting machines are moved from place to place on this caterpillar-mounted transfer truck.



[FIRST OF THREE ARTICLES ON ROOF SUPPORT]

ROOF-CONTROL PROBLEMS

+ In Entries and Headings

In Flat-Lying Coal Seams

By PHILIP B. BUCKY

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EXECUTIVES who have any doubts in their own minds as to the importance of roof-support problems in efficient and economical mining will find it dividend-paying to ask their operating officials:

Why is this method of roof support used?

Why is this size timber used and why not use steel?

Can you prove to me that we need it at all?

If these questions are answered correctly, the door should be opened to reductions in timbering costs in many cases ranging from 25 to as high as 75 per cent.

No Loads vs. Heavy Pressures

On a recent inspection trip there were observed many sets of steel timbers which had rusted through so that practically nothing was left of the web, and rows of wooden props either so rotten they crumbled at the touch, or else twisted and cracked. In each of these cases the roof and bottom apparently were in good shape. The preceding observations may be considered as evidence that the timbers are at present carrying no load and the question therefore is raised as to whether they were ever necessary.

In a haulageway visited there was evidence of great pressure as the steel timber sets were twisted out of shape every six months. These were then replaced by approximately 14-in. wooden sets which also gave way in the same time. The bottom rock flowed—i.e., heaved—at the rate of about 1 in. every six months. There were no apparent cracks in the bottom rock but the heave was pronounced and bottom was shot whenever the cars no longer had clearances.

At present a preference for wood support is expressed because it gives better visual evidence of pressure coming on it. The cost of a wooden set is approximately $100, its life is about six months, and they are placed on approximately 3-ft. centers. Here is conclusive evidence of great pressure and the following questions may logically be raised.

1. Will any amount of artificial support appreciably arrest the upward movement of the bottom?

2. Will not small 2-in. timber sets give as good visual observations of roof or bottom movement as 14-in. ones?

3. Could not a substitute haulageway be driven where maintenance costs would not be so high?

Another observation made several years ago was the following: An opening was being driven and small timbers were placed. These gave evidence of weight by splitting and deforming. They were then replaced by larger timbers which after a short time also gave evidence of load, when a third and possibly a fourth replacement of timber took place, each being larger than the previous one. Finally the timber apparently held and the management believed it had determined the correct size and spacing of timber required.

Problems May Be Solved

If the reader will compare this observation with the first one referring to the presence of rusted steel sets and rotten and deformed timber he will have some food for thought. It will be the author's effort to show that these problems may be solved and timber or steel sizes reasonably approximated for safe and economical mine operation.

If one considers the mine openings and the surrounding geologic material as a structure, then the fundamentals of barodynamics, mechanics and structural design may be applied and reasonably correct solutions obtained. To attack the support problem logically one must therefore know the geological and structural characteristics of all the beds from at least the bottom rock to the surface. One should also know the method of mining, and the present

and proposed location of all openings and their dimensions. Mining companies at present are willing to spend large sums for exploratory work and drilling to prove a coal bed or ore body. They must now realize that an additional sum spent for acquiring structural information to place in the hands of a competent individual will result in increased safety and large savings in production costs.

The support problem in mines may be considered under the following headings, for flat and inclined deposits:

1. The permanent support of everything to the surface in shafts, gangways and entries.
2. The temporary support of the underweight in rooms, breasts, chambers and stopes, if a stope or room-and-pillar system is used without robbing; in addition to the permanent support of the overlying beds if the surface is valuable.
3. The temporary support of both the underweight and overweight when retreating, working longwall, or using a caving or stop slicing system.

This instalment will deal only with support of haulage or airways in level strata. The problem in this type of gangway or entry may be treated under three general heads:

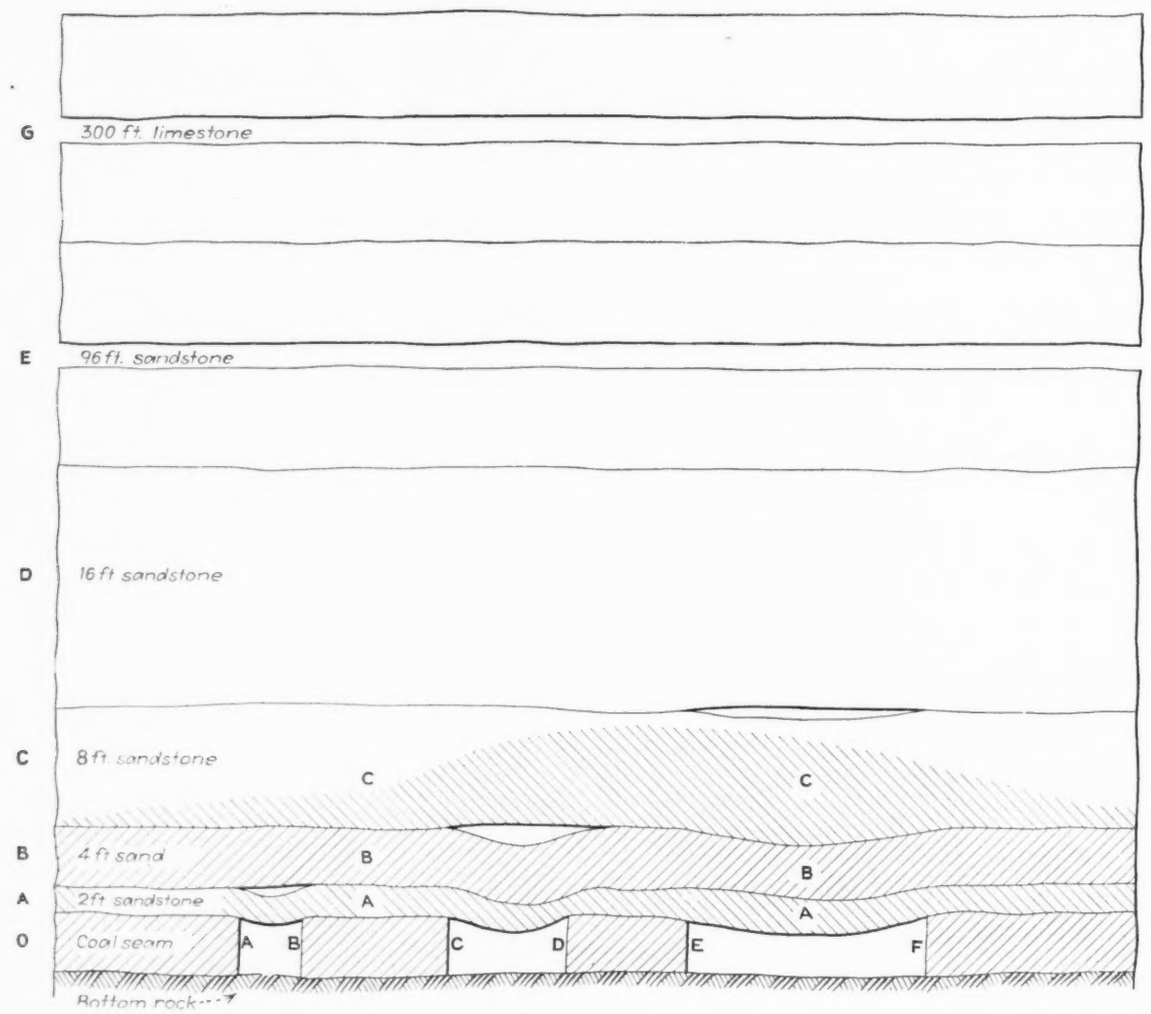
1. Local support.
2. Support of the underweight.
3. Support of the overweight.

Local Support—In driving drifts, gangways, rooms, breasts or stopes, blasting at the face affects the roof rock, which may result in local slabs so loosened by the blasting and subsequent load due to span, that they fall out. The test for a loose slab is to strike it with a steel and judge by the sound whether it is safe. The procedure for safety is either to trim it down or support it. The size of timber used for support is purely a matter of judgment, and there is at present no practical method for determining with reasonable accuracy the amount of timber necessary for local support. It probably is the greatest contributing factor to accidents caused by falls of rock.

In bituminous mines using cutting machines this difficulty may be overcome by making a top instead of a bottom cut, leaving a few inches of coal in the roof and then, if the contact between coal and roof is weak, in barring it down. In mines which use no cutting machines an extra set of reliever holes near the roof and lightly charged, while increasing the amount of drilling necessary, would certainly reduce support costs and make the mine safer. With a poor roof, a method of drilling calling for a bottom cut with a set of relievers and back holes should give good results. Trimming should always be carefully done.

The Underweight—Fig. 1 shows a geological section of a coal seam and its associated strata. The under-

Fig. 1—Typical stratification overlying coal seam



weight is that portion of the material overlying an opening which must be supported artificially or which does not carry any portion of the load of the materials above it. For a small opening, *A-B,* Fig. 1, the underweight would consist only of bed *A*—i.e., 2 ft. of sandstone—and the support problem would be simple. With a larger opening, *C-D,* the underweight would consist of beds *A* and *B,* and the amount of artificial support would be increased. With a still larger opening, *E-F,* the underweight would consist of beds *A, B* and *C.* The opening may be increased in size for this type of structure until support would have to be provided for everything up to the surface.

Artificial support problems in mining are mainly concerned with the underweight and if the geologic structure and structural rock characteristics are such that great weight must be supported, caving methods must be resorted to where the span kept open is small. This development from practical experience is a very important one and all that can be done at present, even with advanced scientific knowledge, is to help refine it.

Overweight—The support of the overweight in room-and-pillar mining and especially at gangways, entries or drifts should be taken care of by pillars of coal or ore. One thousand feet of cover means loads of at least 1,500 lb. per square inch, and if an opening of any size is to be kept, it means the use of relatively large quantities of expensive materials, as steel or some other metal, for wood is good only at 1,000 lb. per square inch and concrete at not much more. The position of haulage and airways which have a long life therefore is a consideration requiring careful study and barodynamic tests if a company does not wish to see maintenance costs eat up its profits.

Structural Characteristics

Let it now be assumed that the structural characteristics of all the rocks making up the geologic section are known and that it is desired to drive a drift, entry, or gangway in the coal or ore. Table I gives this data.

Size of Entry Requiring No Artificial Support—From Fig. 1 it may be noted that the bed determining the maximum size of entry without artificial support is bed *A*, composed of 2 ft. of sandstone. The structural characteristics are given in Table I, and if a safety factor of 10 is used the allowable tensile strength will be $\frac{200}{10}$ or 20 lb. per square inch. The span may now be obtained from the following formulas:

$$S_p = \sqrt[2]{\frac{2T^2S}{W}} = (1)$$

Where S_p = safe span

T = thickness of roof beam in feet (2)

S = allowable tensile strength in roof beam in pounds per square foot = 144 × 20 = 2880 lb. per square foot.

W = roof load per foot length and width.

For the sandstone bed *A*

$$S_p = \sqrt[2]{\frac{2 \times 2^2 \times 20 \times 144}{2 \times 150}} = 8.8 + \text{ft.}$$

If it is desired to drive a 20-ft. entry or gangway, support of some kind will be necessary, for, though the 2-ft. sandstone may not come down, it will be unsafe from the point of view of a structure. Let the 4-ft. sandstone bed, *B,* now be examined.

S_p for bed *B* from Formula (1)

$$= \sqrt[2]{\frac{2 \times 4^2 \times 20 \times 144}{4 \times 150}} = 12.4 \text{ ft.}$$

and since this will not stand 20 ft. it will also become part of our underweight.

Investigating bed *C* by Formula (1) we find

$$S_p \text{ for bed } C = \sqrt[2]{\frac{2 \times 8^2 \times 20 \times 144}{8 \times 150}}$$

= 17.5 +

so bed *C* must also be considered as part of our underweight.

Investigating bed *D* one finds S_p for bed *D* from (1) equal to

$$\sqrt[2]{\frac{2 \times 16^2 \times 20 \times 144}{16 \times 150}} \text{ or } 24.8 \text{ ft.}$$

It is evident therefore that the load to be supported for a 20-ft. entry or gangway is due to beds *A, B* and *C,* since bed *D* will support itself.

An interesting fact from the preceding calculations is that if the 2-ft. bed *A* is not to come down and have a safety factor of 10, then prop or support lines must be so placed that there shall be no open span greater than 8.8 ft.

If the bed *A* is shot down and gobbed, then an open unsupported span of 12.4 ft. may be had, and if a wider opening is desired then support will be needed, but the maximum distance between support lines is limited to 12.4 ft. The preceding reasoning may also be followed with reference to the shooting of beds *A* and *B,* when a larger span may be worked.

Let it now be assumed that a 16-ft. entry or gangway is desired which will give two haulageways at least 7 ft. in the clear, and see what type of support is desirable if no roof is taken.

The support possibilities are:

1. A line of props down the center.
2. Horizontal roof timbers set in hitches in the wall.
3. A three-piece set.
4. A four-piece set with a center post.

Center Prop Line—If a line of props be placed down the center line of this opening at 5-ft. centers as the entry is driven and if these props are tightly wedged into position with hardwood or steel wedges, then the load per prop would approximate 426 × 5 × 8 ×150 lb. or 2,556,000 lb. (see Fig. 1), and assuming timber strength at 1,000 lb. per square inch in compression, then the prop required would have an area of 2,556 sq.in. or a 57-in. diameter. In other words, it would be practically impossible to get enough timber to support the load. If, however, beds *A* and *B* were allowed to deflect or sag away from the upper beds, then the maximum load per prop would be considerably reduced, would be due to beds *A* and *B* and equal to (a + b) 6 × 5 × 8 × 150, or 36,000 lb., which calls for wooden props with 36 sq.in. of cross-sectional area or 6.8 in. in diameter.

Table I—Structural Characteristics of Beds in Fig. 1

	b	O	ABCDEF	G
Bed or Beds	Bottom Rock	Ore body		
Material	Hard sandstone	Coal	Sandstones	Limestones
Tensile Strength So	400 lb./per sq. in.	200 lb./sq. in.	200 lb. per sq. in.	600 lb./sq. in.
Compressive Strength C	5,000 lb./sq. in.	2,000 lb./sq. in.	2,000 lb./sq. in.	6,000 lb./sq. in.
Shear Strength Sb	3,000 lb./sq. in.	1,000 lb./sq. in.	2,000 lb./sq. in.	2,000 lb./sq. in.
Modulus of elasticity E	$5x10^6$	$5x10^5$	10^6	$5x10^6$
Modulus of rupture R	800 lb. per sq. in.	300 lb./sq. in.	500 lb./sq. in.	1,500 lb./sq. in.
Weight per cubic foot	150 lb.	80 lb.	150 lb.	150

If this prop be now investigated for shear, one finds that its perimeter is 6.8π and its shear area is $6.8\pi \times 72$ in., or 1,540 in., which will withstand a shear stress of $1{,}540 \times 2{,}000$ or 3,080,000 lb., amply sufficient to take care of the 36,000 lb. it must bear. A line of 6.8-in. props would support this opening provided they were pointed and placed as the entry was driven or wedged in place with wood which would allow beds *A* and *B* to sag away from the overlying beds.

Practical experience has taught that under certain conditions no prop would stand, but that if it was pointed or used with a cap of soft material the prop's ability to withstand load was apparently increased. The practice is logical and sound, although it is believed that only in recent times has the correct logic become known.

Steel vs. Wood

Some mines are now replacing wood with steel timbers. The main objection to steel timbers is that they give no warning when failing. It is granted that wood is a better visual indicator of roof or bottom movement than steel, but steel is better for support. There is no reason why steel timbers cannot be used in conjunction with small 1- or 2-in. wood props alongside at intervals to serve as warnings. For the above load in a 5-ft. coal bed or ore body a 3½-in. standard steel-pipe column with welded top and bottom plates 6 in. in diameter weighing 9.11 lb. per foot, or 45.55 lb. per prop, will be amply sufficient to carry the load. A 6.8-in. timber prop 5 ft. long probably will weigh 82 lb., so that there is some advantage for steel from the standpoint of weight. An aluminum prop to support the same load would weigh two-thirds that of the steel prop, or 30 lb., and cost approximately 20c. per pound, as against 3c. for steel. If steel is cared for it will have a long life.

Allowing for the Supporting Power of the Underweight—The underweight consists of beds *A* and *B*—i.e., 6 ft. of sandstone—and, since the sandstone has some strength, let it be allowed to support itself to the point where the maximum stresses induced are 20 lb. per square inch—i.e., the maximum allowable with a safety factor of 10.

The procedure is to determine first the load per foot on bed *B* that will do this from the formula

$$W = \frac{2\,D^2 S}{S_p^3} \qquad (2)$$

on substituting in (2) one obtains

$$W = \frac{2 \times 4^2 \times 20 \times 144}{16^2}$$

$= 360$ lb. per foot.

Now determine the deflection of bed *B* from formula (3) $d = \dfrac{W\,S_p^4}{384\,EI}$

Where d = deflection in feet, I = moment of inertia and other values are as previously given. On substituting in (3) one obtains $d = \dfrac{360 \times 16^4 \times 12}{384 \times 10^6 \times 1 \times 4^3} = 0.0115$ ft.

Now calculate load W bed *A* supports in pounds per foot, assuming 0.0115 ft. deflection d from

$$W = \frac{384\,E\,I\,d}{S_p^4} \qquad (4)$$

which gives $W = \dfrac{384 \times 10^6 \times 2^3 \times 0.0115}{12 \times 16^4} = 45 +$ lb.

The load per foot to be supported now equals $(6 \times 150) - (360 \times 45)$, or 495 lb.; assumed as 500.

And the load per prop $= (5 \times 8 \times 500)$ or 20,000, as compared to 36,000 previously calculated, which means that a wooden prop of 20-in. area or 5.1-in. diameter will handle the load. This wooden prop will weigh about 48 ± lb. A standard pipe column 3 in. in diameter and weighing 7.58 lb. per foot, or 38 lb. per prop, will also handle the load and 6-in.-diameter plates welded to the top and bottom of this pipe will be amply sufficient to take care of shear load.

Cost Approximations

The points of interest in the preceding statements are: Definite knowledge of the structural characteristics of the material making up this structure makes it possible to obtain a reasonable approximation of the size and amount of support necessary to have a safe entry. With wood props placed with a minimum of barodynamic knowledge and assuming timber in place as costing 10c. per board foot, the cost per prop would be $107, or $21.20 per ft. of entry.

With steel props and assuming up-to-date barodynamic knowledge with steel at 10c. per pound in place, the cost per prop would be under $4, or 80c. per foot of entry.

With wood, and applying barodynamic principles, a 5.1-in. prop would be required whose area is 20 sq.in. and which at 10c. per board foot treated and in place will cost about 84c. per prop, so that the cost per foot of entry will be 17c.

Horizontal Timbers Set in Hitches in the Walls—This is illustrated in Fig. 2 and apparently is a logical method for supporting a weak roof. The arguments advanced for its use are: (1) that in strata whose strength is several thousand pounds per square inch in compression it seems illogical to use wood posts capable of withstanding only 1,000 lb. per square inch when such large pillar areas are available; (2) that the complete width of entry is available for use; (3) there is less air resistance. There is no disagreement with points 2 and 3, but from the standpoint of a structure, point (1) is open to question and the working height of entry is decreased. For this paper let it be assumed, therefore, that hitches in the walls are cut giving a bearing area of 1½ ft. If the cap is then wedged or concreted solidly into place it may be considered a restrained beam loaded at the center.

Horizontal Beams

The load with 5 ft. spacing for comparison, will be $5 \times 16 \times 500$ lb., or 40,000 lb., and from handbooks one finds that a *C B* 120, 12x8-in. beam weighing 45 lb. per foot will carry a 43,700-lb. load on a 16-ft. span. The weight of this beam to be handled is therefore 19×45 lb., or 855 lb., as against 38 lb. for the steel prop line in the center. The cost will be $85.50 per beam, or $17.10 per foot of entry. In placing horizontal beams they should be placed 2 to 4 in. below the roof and wooden wedges placed at the center, the quarter, and eighth points of the beam. This is to allow for roof load distribution and deflection. It also becomes evident that the field of support of horizontal beams is mainly thin roof sections of not much weight, for with large weights the vertical beam dimension becomes large, thus decreasing the height available for haulage. A large clear span, however, is obtainable with this type of support.

The Three-Piece Set—This set consists of two posts and a cap piece—Fig. 3. It should be wedged tight with metal or hardwood over the posts, and wedges should be placed over the cap, as for the horizontal timber set in hitches in the wall. With these conditions the cap is a restrained beam and the posts support the load on it. The cap piece will be of the same cross-section as the previous one, but only 16 ft. in length. It is a 12-in. 45-lb. beam and weighs 16×45, or 720 lb. The posts support the same load as previously and, since two are available, each post takes

20,000 lb. and the post conditions will be met with 2½-in. 5.79-lb. standard pipe columns, or a section built of light channels with spacers. The weight of posts is then $2\times5\times5.79 = 58$ lb. and the total weight per set is 720+58, or 778 lb. Additional baseplates and connections make this approximate the weight of the previous one, but it cuts down the width of entry by 6 in., increases air resistance and provides no additional height.

Four-Piece Set With Center Post—This set is illustrated in Fig. 4. Strong hardwood or steel wedges should be driven over the posts adjacent to the ribs. Soft-wood wedges over the center posts and at the half and quarter points between the posts also should be placed. The set should be 2 to 4 in. shorter than the height of entry. This structure may be considered a continuous beam with two equal spans and the load on the posts nearest the ribs is $\frac{WL}{2}$ or $\frac{1}{2}\times8\times5\times500$, or 10,000 lb., while the load on the center post is WL or $8\times5\times500 = 20{,}000$ lb.

The rib posts may be of wood 10 sq.in. in area or 3.6+ in. in diameter. While the center post may be 20.0 sq.in. in area or 5.1+ in. in diameter or, from handbooks, the rib and center posts may be 2½-in. standard pipe columns or light channels with spacers to get the L/R ratio less than 60. The cap piece will take a load equivalent to 20,000-lb. over an 8-ft. span and this may be taken care of by an 8 in. x 4 in. 20.5 lb. beam.

The total weight of steel required is therefore

For cap piece 16×20.5 lb. $= 328$ lb.
For posts $3 \times 4.5 \times 5.8 = 78$ lb.
For connections 44 lb.
or a total of 450 lb.

This makes the cost $45.00 per set, or $9.00 per foot of entry.

Steel Weights and Costs

It might be well to summarize here the figures obtained: The initial cost for supporting two 7+ ft. spans with full headroom and props placed at 5-ft. centers along the center line will be 17c. per foot if wooden props are used, and 80c. per foot if steel props are used. If a four-piece set is used the cost per foot will be $9.00.

The use of a horizontal cap and hitches or a three-piece set will result in an initial cost of $17.10 per foot, a decrease of at least 1 ft. in headroom, and in keeping a span of at least 15 ft. open.

From the standpoint of maintenance it is believed that steel will have a lower cost, as it is relatively easy to keep in good condition with an annual painting. The life of treated timber may be assumed at ten years, after which a replacement will be necessary.

It thus becomes evident that logical handling of this support problem may result in an initial saving per mile of entry of 5280 ($17.10—0.24) or $89,020—a rather impressive item.

Summary of Conclusions—The following conclusions may be drawn with reference to openings in flat-lying deposits where the geology and structural characteristics of the beds are known:

1. It may be determined whether artificial support is necessary or not.
2. If posts or props are used along the center line of an opening, they should be pointed or have yielding wedges.
3. Cap pieces should be wedged tightly with metal or hardwood non-yielding wedges at the walls or ribs or over posts at the walls or ribs. They should be wedged with yielding wedges at all other points.
4. The size of wood or steel mem-

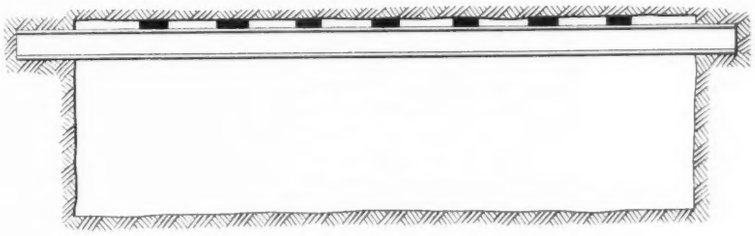


Fig. 2—Hitch method of timbering

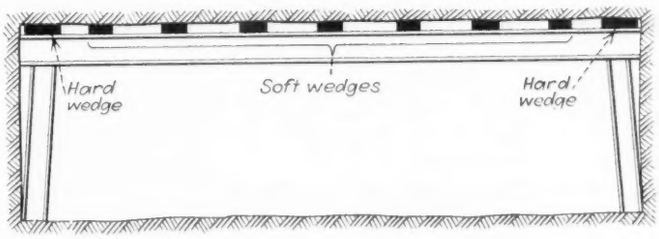


Fig. 3—Posts and stringer set

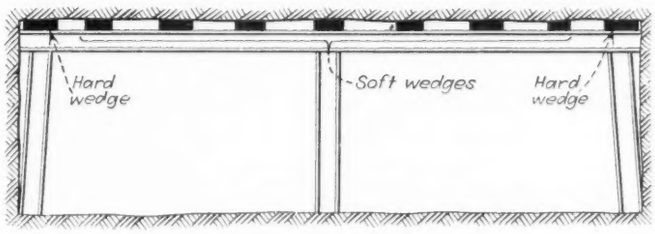


Fig. 4—Three-post stringer set

ber used for artificial support may be materially reduced by allowing the immediate roof to assume part of the load.

A procedure has been presented which enables one to approximate the artificial support necessary for relatively small openings in flat or inclined deposits where the long dimension of the opening parallels the dip. These approximations are based on fundamentally sound principles used in other fields. In working dipping deposits even of small degree where openings do not parallel the dip, problems of importance and interest to the operating man occur. These, and the support of breasts, rooms, stopes and longwall faces will be the subject of articles in subsequent issues.

INTAKE SHAFT

+ Protected Against Frost

By F. B. DUNBAR
General Manager, Mather Colliery

CONCRETE - LINED shafts when used as intakes have given much trouble in the Northern States, for a little moisture back of the lining will freeze, expand and destroy the concrete. Pickands, Mather & Co. had such a shaft at Mather Colliery, south of Pittsburgh, near Brownsville, Pa., and in order to keep the shaft in operation a crew of six to eight men was kept busy every night repairing damage. It now gives no trouble.

Concrete Used in 1901

The first shafts in the Pittsburgh region to be lined with concrete were constructed in 1901. After a lapse of several years, the H. C. Frick Coke Co. sunk three shafts between Uniontown and Brownsville, lining them with concrete and, in so doing, set the pace for this type of construction. But a few years later, it was noted that, in downcast shafts, concrete linings were spalling. This was presumed to be due to the moisture on the face of the lining freezing during winter months.

No matter how rich in cement the concrete or how dense it may have been made, the result was the same. In some notable shaft installations, there has been little deterioration, but in these cases the linings were carefully drained with hidden conductor pipes or had protective coatings applied to the face of the lining. However, no waterproof coating seems to have been found that will cling infallibly to the minute pores of the concrete face and that can be applied successfully to a face which is even slightly moistened. For these reasons it has been necessary to reline many shafts.

In 1917 a hoisting, downcast shaft, sunk at Mather Colliery by a reputable firm according to the best standards then in practice, was lined with concrete throughout. Only about three-quarters of the work was then completed; the rest of the construction, including arches, curtain wall, guides and buntons, was finished by R. G. Johnson Co., Washington, Pa., in 1918. This shaft measured 12 ft. x 35 ft. 4 in. within the lining. Only 23 ft. 4 in. of this was full width, for the two ends were struck on a radius of 6 ft. The depth from top of rail at collar to top of rail at shaft bottom was 338 ft. 10½ in. In 1918, concrete arches were erected at the foot of the shaft; a curtain wall was introduced, cutting off one end of the shaft from the hoisting compartments; and guides and buntons were added.

Section Renewed After 1926

By 1926, the shaft, though at no time making more than 10 or 15 gal. of water per minute, began to give much trouble from a point 33 ft. 5 in. below top of rail at collar for a distance of 204 ft. 1½ in. down the shaft. So this section was renewed by the R. G. Johnson Co., after discussion with the management, in a manner later to be described. The circular end that had been curtained off proved to be in passable condition and was not renewed, but by 1936 all the rest of the shaft was in need of renovation and, as the part already repaired had shown such excellent resistant qualities, it was decided to have that company renovate the rest of the shaft. Some shafts, relined as far back as 1925 by this method, have shown no disintegration.

Old Lining Chipped Back

In the relining of the shaft, the old lining was chipped back to solid material and drilled, so that binding ¾-in. steel rods of suitable length at 3-ft. centers could be inserted to tie the new lining to the remaining concrete or rock. Long vertical pipes, reaching from top to bottom of the shaft, were put into recesses cut in the sides of the shaft. Wyes were connected with the vertical pipes wherever water was dripping from the measures. But some water seeped so slowly from the rock and concrete faces that it did not drip. This water also had to be removed. Thin flashing plates were put against the shaft faces so as to prevent the concrete making tight contact at these places and to provide water with a means of passage; wyes were put into the vertical pipes at the base of these plates so that this water also could be collected—a process known as "panning."

Vitrified brick was laid in regular sections and backed, between the old solid concrete and the brick facing, with new 1:2:4 concrete with pea

gravel as the coarse material in the aggregate. Only the hardest and most water-resistant bricks were used. They were laid in stringer courses around the shaft with a header course at 6-ft. intervals. The bricks measured 4x4½x8 in., their exposed faces being 4½x8 in. and the depth in the wall 4 in.; cement mortar mix was 1:2. The old curtain wall, though not backed against the damp sides of the roof but exposed on both sides to the entering air, had become weakened. As it no longer served any useful purpose it was removed.

No Forms Used in Work

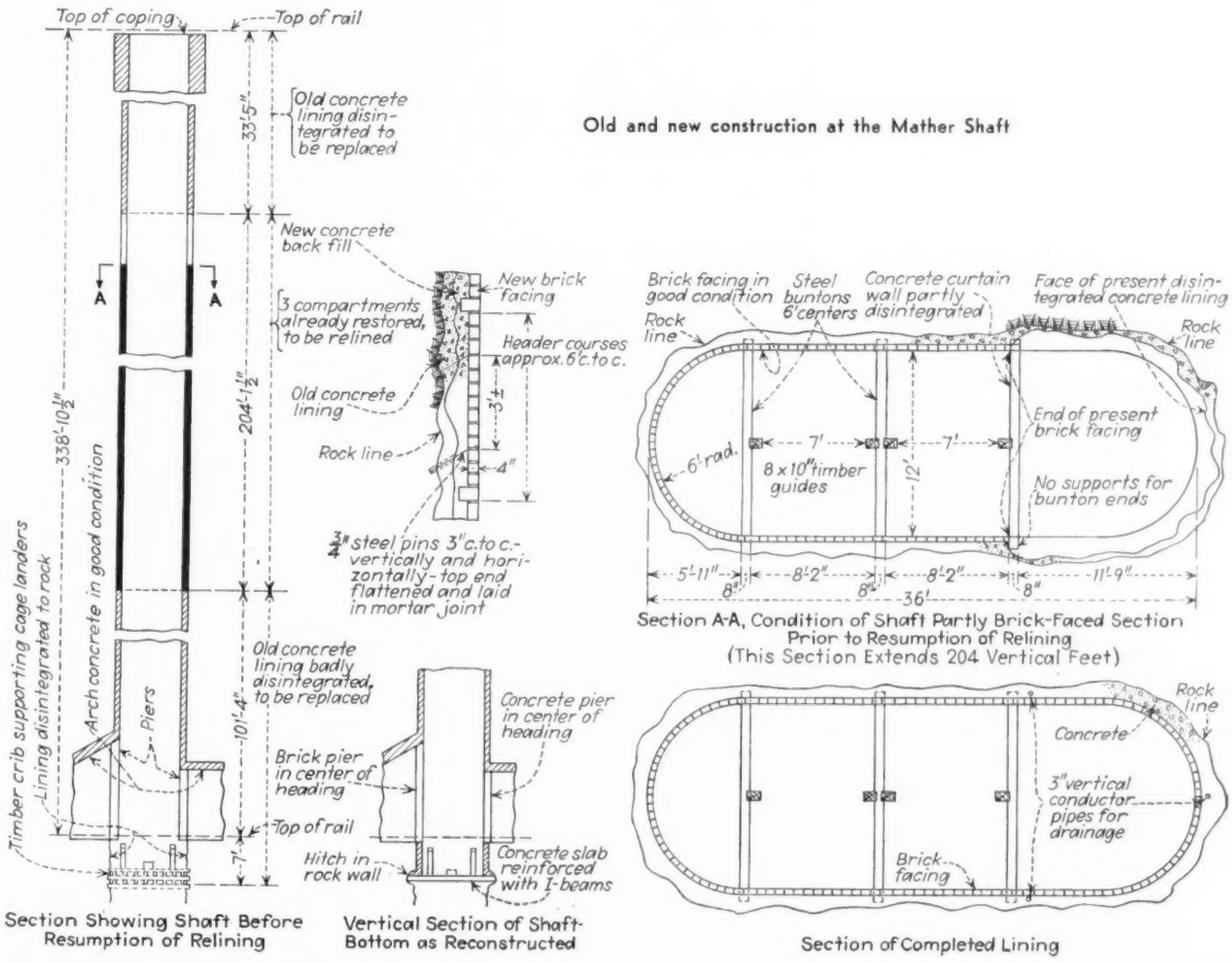
Only a limited number of courses of brick could be placed at any one time, for the section had to be backed by concrete the next day when the excessive hydrostatic pressure might bulge or collapse the brickwork, for the mortar in which the bricks were laid still would be relatively "green." If forms could have been used, this provision would have been unnecessary, but this was impossible, as the clearance between face of lining and cage was too limited to permit of the use of such forms while coal was being hoisted, as was obligatory between shifts devoted to the renovation of the shaft. All the work had to be done in the warm weather. Spring, summer, and early fall are the only periods during which work can be satisfactorily performed in a downcast shaft.

At times, reliance has been placed on grouting as means of keeping the walls of a shaft free from water, but experience shows that the pressure of the grouting chases the water around the lining, so that it will appear often months later in moist spots or trickles in other sections of the shaft. The only safe way is to remove the water speedily by pipes. No one will build a wall of any height without providing "weep holes," and probably pipes formerly were not placed in and down the walls of a shaft to carry away water because the ground water and shaft walls were believed to be kept warm by the heat of the measures. These are far from sufficient reasons when winter air is to be passed in large volumes down a shaft, for even a little frost will exert a bursting pressure on the lining. In fact, there is far more need to protect a shaft by weep holes (directed vertically, however; not horizontally) than thus to protect a retaining wall unless the latter develops an unusually large volume of water.

Long Life Promised

A pit had been sunk below the Mather Shaft, in which piers of timber cribbing had been erected as a false bottom to support the cage landers. As its lining had disintegrated, it was not found possible to maintain the sides or false bottom of this pit. When the shaft was renovated, the cribs were removed, and concrete was used for a new lining and false bottom; the latter was a slab reinforced by I-beams. Since those several changes were made, no repairs have been necessary and no trouble is anticipated. Twelve years without damage to the lining first placed gives promise of long life for the new as well as for the older portion of the work. A number of other shafts have been lined or repaired in similar manner.

Old and new construction at the Mather Shaft



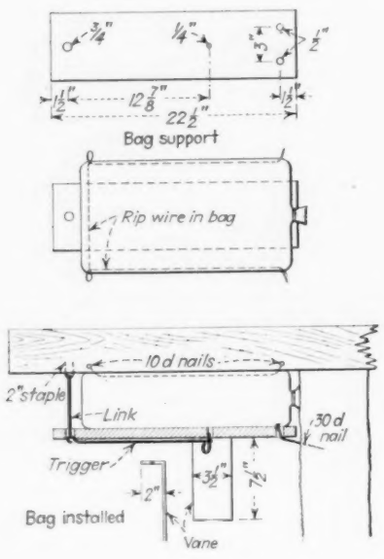
NEW EXPLOSION PROTECTION

+ Makes Use of Rock Dust in Paper Bags Torn Open by Rip Wires

MAXIMUM protection against the spread of mine explosions is best afforded by complete rock-dusting of all openings in a mine, leading safety authorities contend. And initial dusting must be followed by redusting at intervals to keep the incombustible content of the mine dust at the proper figure. Dusting and redusting are comparatively simple tasks where openings are provided with track and track-mounted dusting equipment can be used. But in aircourses and other openings without track, maintenance of the proper percentage of inert material requires the use of a high-pressure distributor and hose as a rule—a costly operation and possibly, under certain conditions, physically impossible. Rock-dust barriers consequently have been devised to meet the cost and physical limitations of protecting trackless openings in coal mines.

The latest development in this protection is the bag type of installation now used in the mines of the Old Ben Coal Corporation, in southern Illinois, and the Glen Rogers (W. Va.) mine of the Raleigh-Wyoming Mining Co. The use of rock dust goes back to 1917 at the Old Ben mines, and on Jan. 5, 1926, a patent on most of the basic features of the rock-dusting methods, including barriers, and rock-dusting equipment now used in the bituminous industry was granted to John E. Jones, Old Ben safety engineer; the Old Ben company gave the right of free use of the equipment and methods covered by the patent to the government and the people of the United States.

Fig. 1—Details of bag support and trigger apparatus.

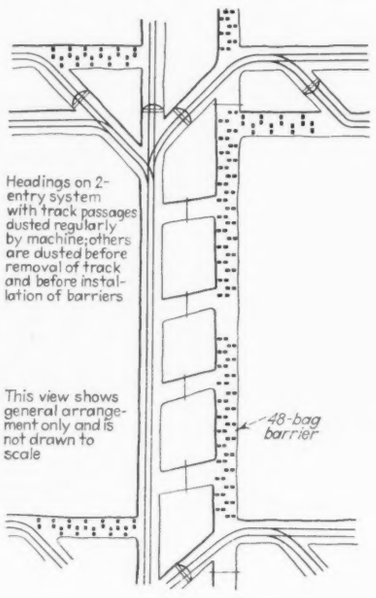


Uses Dust in Bags

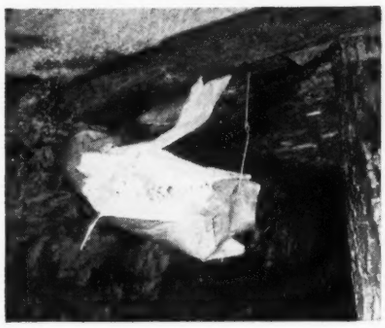
Existing types of barriers were not, however, in Mr. Jones' opinion, entirely satisfactory for several reasons. which led him to develop the bag principle herein described, on which a patent was granted on Dec. 14, 1937. The major objective in the development of the new protective system was the use of the rock dust in the original container—i.e., a paper bag—in which it could be kept clean and free of contamination until released by the air pressure preceding an explosion. Simplicity in construction and operation of the system and availability of the dust regardless of the length of time that might elapse between bag-unit installation and explosion occurrence were additional objectives. For protection against the agglomerating effect of moisture or dripping water, waterproofed bags were proposed. However, a water-repellent dust now is available. Other advantages include a readily accessible supply of rock dust at short intervals throughout the mine for use in case of a mine fire, no matter where it may occur, and adaptability to removal and subsequent reinstallation in another part of the mine in case the original section is worked out and closed or sealed.

Carrying out the idea of using the dust in the original container, the new system is composed of a number of individual bag units, each with a means of automatically ripping the bag and freeing the dust

Fig. 2—Diagrammatic plan showing use of bag installations for the protection of an entry off which room panels are turned.



Bag unit in place, showing tripping vane and method of suspending the drop end by means of the trigger mechanism.



Here a bag unit has been tripped and the top torn off by the rip wires fastened to the crosspiece. The contact pin and loop at the end of the trigger check the fall of the bag support at the point shown, leaving the dust up close to the roof.

as a result of the action of the pressure wave preceding the explosion. This construction has the advantage that failure of one bag unit to rip has no effect on the ripping of the remainder. At the same time, the bag units are installed in such fashion that if they are ripped accidentally very little dust falls to the floor, the most of it remaining in position near the roof, where it is most effective.

In arriving at a method of using dust in paper bags a number of different plans were considered, including open bags or halved bags on tipping supports, various methods of ripping bags, etc. All of these were open to the objection that they either were too slow or discharged the dust in a mass on the floor, so that the system finally settled on was based on placing the bag on a horizontal supporting board arranged so that it would be tripped automatically by the explosion pressure wave and drop down a limited distance at one end to make possible ripping the bag open on the top.

In the new system, a trigger holds the board in the horizontal position and at the same time supports it at one end as shown in the accompanying illustrations. The trigger is held in place by the weight of the bag of dust acting to press the trigger-contact pin against the side of a hole in the support board. A galvanized-sheet vane held in position by the trigger when the latter is in place acts as the tripping device. A 30-deg. movement of the vane from the vertical is sufficient to pull the contact pin out of the hole and trip the device so that the bag will be torn open. A loop at the contact end of the trigger, plus the contact pin, acts as a stop to limit the distance the loose end of the support board can drop and thus keep the bulk of the dust up next to the roof —the preferable place in the opinion of safety authorities.

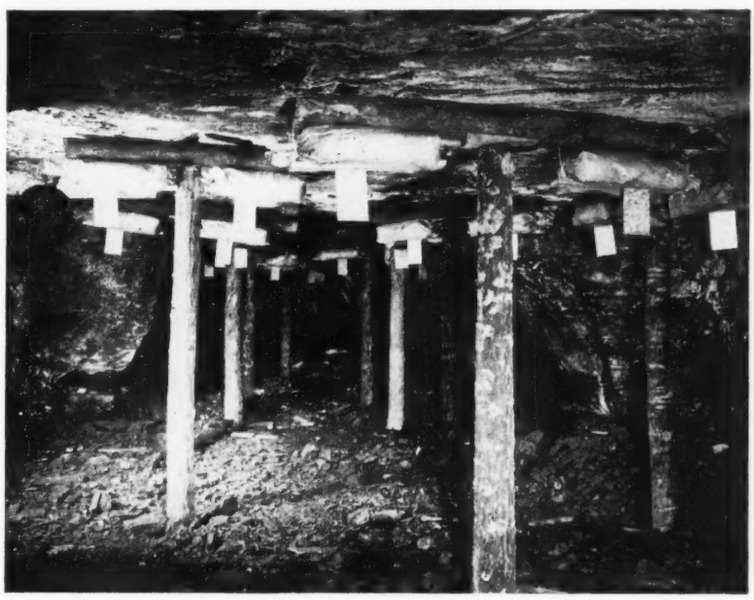
The bag support now in use in Old Ben and Raleigh-Wyoming mines is a 6-in.-wide 1-in.-thick board. It is planned in future installations to use boards treated with a wood preservative for permanency. Two holes are bored in the hinge end of the board to permit attaching it to an overhead member by wire or to an upright by heavy nails bent up to form hooks after they have been driven partly in. A hole at the opposite end to permit the trigger and its supporting link to be threaded through and a center hole for the contact pin complete boring operations on the support board.

Bags usually are hung in pairs on a crosspiece—generally a tie—held in place against the roof by a center post. However, the bags, on their supporting boards, may be suspended on the regular roof support, either wood or steel, or from plugs in the roof or ribs if no timbering is done. But even if timbering is not the usual practice, posts and crosspieces are recommended, as they protect the roof at the point where the bags are installed. Where wood timbering is employed, the support board first is hung from the hinge end by a wire stapled to the regular crosspiece or the regular timbering or lagging, or by nails in the post. Then the wire link and trigger are threaded through the proper hole and are stapled in place at the opposite end. A rip wire is threaded through the rock-dust bag, as shown in Fig. 1. The bag then is laid on the support board. Support and bag then are raised to the horizontal position, the vane is placed over the contact pin and the trigger is raised to place the contact pin in the center hole. A pull on the drop end of the support then brings the contact pin firmly against the side of the center hole, where it remains until pulled out by the action of the vane.

When the support is fixed in position, the bag should be pressed firmly against the crosspiece. The rip wire then is fastened to a nail in the crosspiece at one corner of the bag, pulled tight through the bag and wrapped twice around the nail at the second corner. This operation is repeated with a nail at the third corner on the opposite side of the bag, ending up with tying the other end of the wire around a nail at the fourth corner. Under this plan, the top of the bag is ripped out along both sides and one end when the support is tripped, as shown in an accompanying illustration.

Fifty-pound bags of rock dust are

Part of a 48-bag installation in Old Ben No. 15 mine, showing method of installation.



used in erecting the barriers. This lighter weight of bag was chosen for greater ease of installation. The number of bags constituting a unit installation may be varied to suit conditions, but at Old Ben and Raleigh-Wyoming the usual number for a heading consists of 48 bags on 24 crosspieces spaced usually approximately 10 ft. apart both inby and outby each panel intersection. Fig. 2 shows diagrammatically how the system may be installed to protect an entry off which room panels are turned. By repeating these installations at the various junction points as they are made or at other regular intervals as the workings are extended, complete protection by zones can be provided.

It will be noted that the bags are installed only in headings where no track is laid. To complete the protective facilities, haulage headings are rock-dusted by machine in accordance with recommended practice; also aircourses before the track is removed. The machine dusting in tracked openings must be renewed from time to time, but the bags last indefinitely, making it unnecessary to continue dusting the other openings and thus materially reducing dusting expense.

Incidentally, when a bag is tripped accidentally it is only necessary, if

Showing a pair of bags after tripping. The one on the right was put up with a 4-in.-wide support, instead of a 6-in., with the result that more of the dust has dropped to the floor.

desired, to lift it up, replace the vane and reset the trigger. Even if it is left down in its tripped position, the bulk of the dust still is in the proper position and—with the bag ripped open—in condition for service, provided the mine is dry. In a damp mine, it might be necessary to install a new unit with the waterproof bag intact, unless water-repellent dust is used.

Bureau of Mines Reports on System

TESTS of the new system were made last winter at the Bruceton (Pa.) experimental mine of the U. S. Bureau of Mines. A report on these tests (R.I. 3411, "Tests of a Barrier Using Rock Dust in Paper Bags," by H. P. Greenwald and H. C. Howarth) embodies the Bureau's conclusions as to how the system measures up to the eight specifications set up for rock-dust barriers. These specifications are:

"1. The barrier itself and its subsequent operation, accidental or otherwise, must not obstruct the passageway to such extent as to reduce appreciably the volume of air flowing therein.

"2. If operated accidentally, barriers must not cause injury to men or interfere with normal mining operations.

"3. When operated by a shock wave, a barrier must retain enough dust to cope with the flame of a delayed explosion. Experience indicates that this retention should be one-fourth to one-third of the original loading.

"4. A barrier must be built close to the mine roof, so that flame cannot pass over it, and must protect the entire width of the passageway.

"5. The rock dust in a barrier must be protected from dampness.

"6. A barrier must be able to stop an explosion approaching it from either direction and must contain enough rock dust for the purpose for which it is designed.

"7. A barrier must be sensitive enough to be operated by the pressure waves in advance of a weak explosion but must not be operated by the shocks accompanying normal mining operations.

"8. The operation of a barrier must disperse the mass of dust it contains and discharge it so that the moving air can form a dense dust cloud."

In the light of the Bruceton tests, the Bureau arrived at the following conclusions on the effectiveness of the bag system:

"1. Installation and subsequent operation of the bag barrier do not restrict the area of passageways 5 ft. or more in height enough to cause an appreciable reduction in the volume of air flowing.

"2. When a unit is operated, the weight of the falling end of the supporting board might give a strong blow to a person standing below it, but it seems doubtful if serious injury could result except under rather unusual circumstances. Operation of the units in trackless entries evidently will not interfere with mining operations. . . .

"3. The amount of rock dust retained in the sack when a unit is operated is variable, but on the average will be more than the minimum of 25 per cent set.

"4. The units can and, of course, must be set close to the roof to prevent flame passing over them. They will protect the entire width of a passageway if the posts are staggered. In wider passageways it may be possible to set the posts so that there are four bags end to end. In still wider passageways it may be necessary to use three lines of posts.

"5. While the paper of the bags is some protection against dampness, it will be affected adversely by extreme conditions and may lose most of its strength. It is not sufficient protection for ordinary limestone dust. The water-repellent properties of treated dust make it particularly valuable for use in barirers. . . .

"6. The vane of the units of the bag barrier will be operated by an explosion approaching in either direction. The quantity of dust in the barrier depends entirely on the number of units put in place. Unless it can be proved beyond doubt that a violent explosion is not possible, the recommendation that there be 60 lb. of dust per square foot of entry cross-section must be retained.

"7. The tests showed that the units will be operated by the shock waves in advance of a weak explosion. It has been reported that some units installed close to advancing faces in commercial mines have been operated by the shocks of blasting. On the whole, the barrier appears to be a little too sensitive rather than not sensitive enough. So far as can be told from reports received, the matter is not serious. . . .

"8. The principal criticism that can be made against the bag barrier is that there is no positive means of dispersing the dust when a unit operates. Such dust as falls when the bag rips tends to form a heap immediately below the bag and dispersion depends almost entirely on the action of the air waves in advance of the explosion. It is true that these air waves produced sufficient dispersion in the double-entry tests made, but the entire range of explosion characteristics was by no means explored. If the barrier contains sufficient dust, it will certainly be successful with strong explosions; it is extremely weak explosions that have the best chance of passing it. There is little chance of an explosion being so weak that it will not operate the units of a barrier when properly installed. The question is whether or not sufficient dust will be dispersed subsequently to quench the flame. This particular point warrants additional research. . . .

"In conclusion, it must be stated that the bag barrier is doubtless cheaper to install and maintain . . . but the financial advantage is accompanied by a loss of efficiency against weak explosions resulting from poorer dispersion of the rock dust."

PUBLIC RELATIONS *for* INDUSTRY

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A Presentation of the Imperative Need of Mutual Understanding in the Conduct of Our Daily Work

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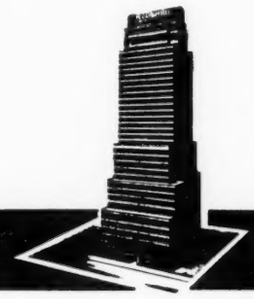


WITH SPECIAL REFERENCE TO COAL MINING

PRESENTED BY **COAL AGE**
A McGRAW-HILL PUBLICATION

AN EDITORIAL SERVICE TO MEET

INDUSTRY'S MAJOR PROBLEM

To the readers of Coal Age:

THERE IS NO DOUBT that today the American people are taking a keener, more critical interest in the conduct of business than ever before. And when I say critical, I mean exactly that. During recent years most of them have suffered loss, either of jobs or of savings, and under such circumstances men are prone to accept without serious question any scapegoat that appears plausible. In the confusion of fears and resentments, they seem to have concluded that short-sighted and selfish business management is chiefly responsible for their misfortune.

However mistaken and unfair such conclusions may be, management cannot ignore them. It must recognize that in the long run the opinions of men are the result of experience, of what happens to them each day, much more than of what they are told.

Progressive management has already faced that fact; has already begun to think and work beyond the technicalities of production and distribution that once absorbed most of its energies. It sees more clearly and deals more proficiently with its human responsibilities. It is learning to reconcile the economic success of the industrial unit with the social welfare of worker and community.

Presently, every business—the small retailer as well as the large manufacturer—must learn how to interpret more convincingly to its own public the social as well as the economic benefits of its policies and accomplishments. Only as each business satisfies the newly aroused and critical interest of people in its affairs will it be able to disarm those who trade on the human tendency to blame our troubles on someone else. Yes, if business as a whole is to win a favorable public opinion, each and every business must act to improve its own public relations.

The readers of this journal, and of other business publications, compose, we believe, a group that can achieve for American business a sound and lasting solution of this vital problem. They alone are in position to shape the working conditions of 21 million employees. They alone can mold the attitude of those other millions who compose the various "publics" to which all business must be responsible.

Heretofore, the function of business papers has been to exchange successful experience; to dig up and disseminate practical facts for the use of their readers, serving primarily the technical and merchandising needs of business. But this matter of human relations has now become of equal importance, for good industrial and public relations, it has been found, reduces corporate losses, removes fear and suspicion, promotes operating efficiencies in both production and sales. A better knowledge of public relations technique is, therefore, quite properly essential for men in, or moving into, positions of greater executive responsibility.

So, beginning with this insert, each McGraw-Hill publication sets out to strengthen its editorial service in the important domain of Public Relations. I hope that the million readers of McGraw-Hill's business papers will get much real and practical help toward building better relationships between their own businesses and their employees, their customers, and the communities in which they must carry on.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Co., Inc.

Why a Public Relations Program

IN LESS than two generations the United States has changed from an agricultural to an industrial nation. Living standards and efficiencies at once the despair and envy of other countries have been created. Foreign delegations still flock to our shores to study our methods so that they may use them as patterns for their own organizations. Yet here at home today these methods and the systems responsible for them are under increasing attack.

Since every person employed in productive enterprise is a part of American industry, these attacks imperil the livelihood of nearly forty million workers and their dependents. The newest addition to the payroll has as much—if not more—at stake as the veteran business executive. That also is true of particular industries which at present may not be under direct fire. All industry is so interrelated and interdependent that even the seemingly immune enterprise must suffer when the legitimate activities and the buying power of their customers, or the customers of their customers, are curtailed.

Ironically enough, public acquiescence in many of the current attacks is an indirect recognition of the satisfactory manner in which our industrial system normally functions. Reasonable opportunities for the employment of those ambitious to put their mental or physical talents to work, and continually rising standards of living have come to be widely accepted as a matter of course. Any unfavorable change in these conditions leaves the general public surprised, confused and resentful. Such reactions as these make it easy for pressure groups to unloose destructive propaganda which further heightens resentments and breeds new misconceptions.

These misconceptions take many forms shaped by the experience, the inexperience, or the special interests of the critics. To one it appears that business can't manage itself and must be owned and managed by the Government. Another believes that employees are underpaid or that stockholders and executives are overpaid. To others corporate surpluses are too high. Many have convinced themselves that power and machines have reduced employment opportunities; and that industry can raise wages and reduce prices while costs go up.

Several misconceptions are based on faulty generalizations. Because a few companies have been remarkably successful, it is argued that all could make money. Because some corporations have been ruthless, all corporations, it is contended, will stoop to unethical conduct to gain their ends. This is like saying: John Smith killed Bill Brown; John Smith is auburn-thatched; all redheads, therefore, are murderers. Unfortunately, those who would indict all business for the crimes of a few are more subtle in their approach and so create an impression not in accord with the facts.

To put it bluntly, American industry, once so highly praised for its contributions to the national well-being, is now on the spot. Prevailing misconceptions of how business operates and what it does have made a field day for those who propose to hamstring or destroy private initiative and individual opportunity. These proposals run a broad gamut: They include public ownership, increasing and rigid federal control at the expense of local autonomy, ill-conceived legislation on hours and wages, labor dictatorships, and confiscatory taxes on thrift and job security.

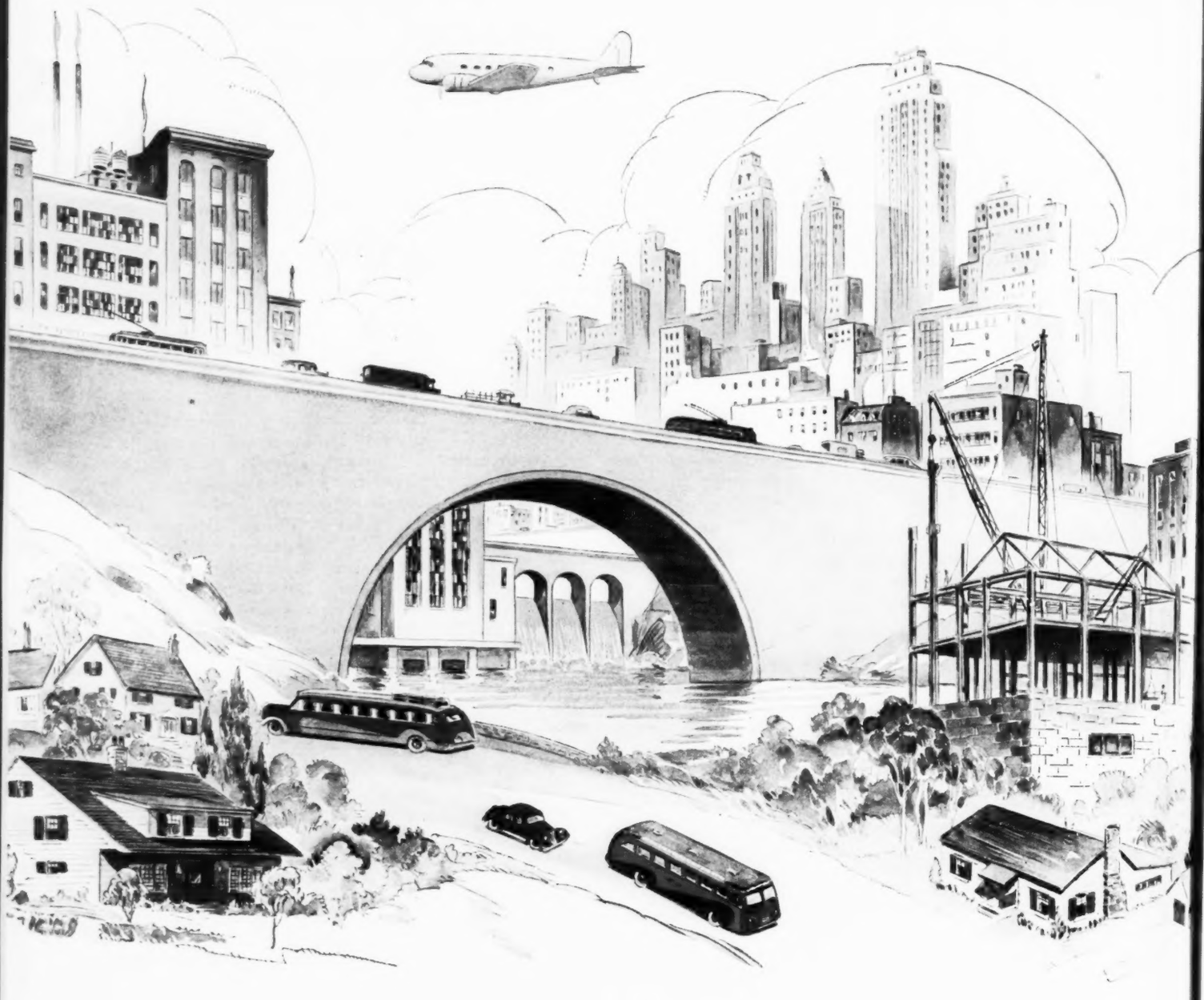
While the man in the street may be criticized for his willingness to swallow these nostrums, he is not wholly to blame. Industry, too, has been at fault, in assuming either that he was fully informed on those phases of its operations which are properly a matter of public interest, or that a healthy curiosity should be discouraged. Misconceptions multiply where the facts are hidden.

The tragedy of the situation lies in the fact that it might easily have been avoided. In the simple days of local and localized industry, everybody connected with a particular enterprise knew everybody else connected with it, and the details of its operations were an open book. The boss and the employees were neighbors; the customers, for the most part, fellow townsmen. Outside purchases were limited largely to those products which the local community neither manufactured nor raised. Competition in the modern sense was practically non-existent.

As industry developed and enlarged its field of operations, much of this early intimate personal touch was lost. The small enterprise grew bigger. In some cases combinations took in the local business and financial control passed out of the community. The local industry which still retained its identity was busy meeting increased competition and seeking to expand its distribution. Little attention was paid to changing conditions that were fostering misconceptions about the personal relations of the business. Bit by bit the close acquaintance and familiarity of the early days disappeared.

Common understanding of these things also was impeded by the greater variety of occupations as industry expanded. Each man's job became so highly specialized that the old feeling of common partnership in a joint undertaking frequently was buried in an exaggerated feeling of the relative importance of his own work. This made it easy for each occupational group to get the idea that its contribution to the undertaking alone was essential and that many of the other groups were parasitic or, at best, unimportant.

Such mistaken beliefs are the exclusive property of no particular group. "Goods are valueless until sold," chants the sales staff; "without us the wheels of industry would cease to turn." The



wheels would turn much faster, growls the production department, "if we didn't have so many lame-brains drawing fat salaries as salesmen." Under the cold glance of both groups, the clerical force heatedly inquires: "How long do you think this business would last if we didn't keep the cost records, send out bills and collect the money for pay checks?" Some executives and engineers, too, have been known to forget that their plans cannot be carried out without the cooperation of other groups.

Possibly the greatest single cause of misunderstanding and friction has been fuzzy thinking on social responsibilities. Many of the responsibilities which rested on the individual or the State in our fathers' and grandfathers' days have been shifted to the shoulders of industry. New ones constantly are added or proposed—often before industry has had time to adjust itself to those which have gone before. Some of these responsibilities affect employee relations; others involve customer relations. The worker, for example, no longer is completely defenseless against the occupational hazards of his employment. "Let the buyer beware" no longer is considered smart merchandising. Many of the changes now embodied in the law were anticipated by industry itself. Opposition — valid or otherwise — to social legislation, however, has been used to damn business in the public eye.

Fortunately, the barriers to good will and common understanding can be broken down. The process is a simple one. It consists chiefly in maintaining good policies in human relationships and in keeping all interested people—employees, stockholders and their neighbors, customers and the general public—informed. It means telling them in plain terms what revenue is received and where it comes from; what revenue is paid out and who gets it; how an industry serves the individual, the community and other industries. Finally, it includes the acceptance of the social responsibilities which the advance of civilization imposes upon business.

Add all these things together and you have public relations.

Most employers are willing to accept their social responsibilities, but they are inexpert in making that acceptance articulate. Too many employers have failed to make clear their policies, their practices and their purposes as they relate to fair dealing with employees,

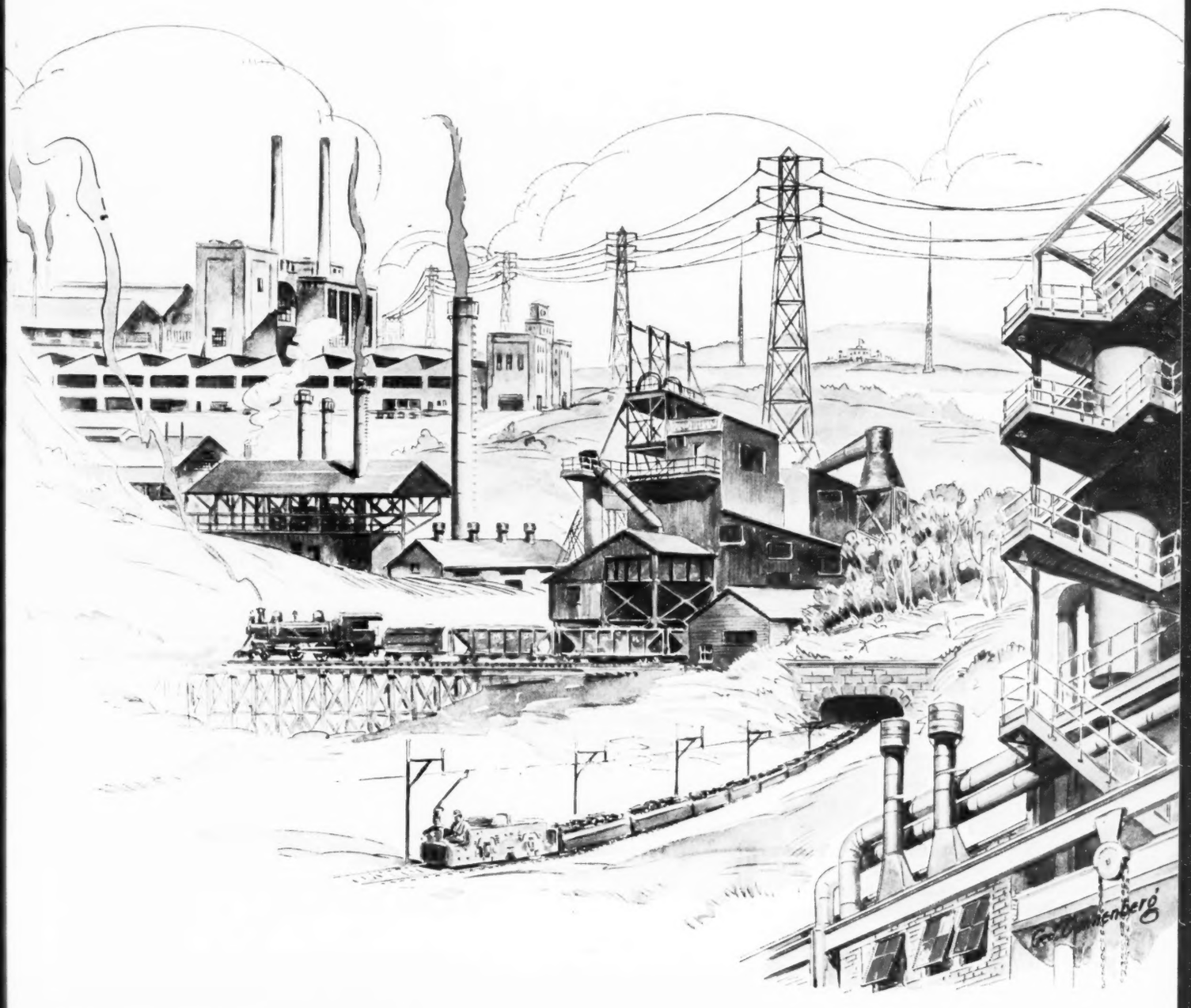
investors and the general public. Their intentions have been good, but they have cloaked them with a veil of secrecy and made a mystery out of simplicity. As a result the uninformed have been given a royal opportunity to exercise their imagination. And they have done it!

Public relations is a comparatively new activity for most business enterprises and involves a technique which too many have not yet learned. Obviously, the first place for each company to start is within its own organization. This is the "inside job" that builds a company's good name among its own family and lays the firm foundation for building public confidence and favor. As one exponent of the art phrases it: "Industry's public relations cannot be one thing and its private actions and policies something else. The two must be in complete accord."

The inside job should present no real difficulties to fair-minded employers. Most workers have a normal predisposition to view in a favorable light the organization in which they earn their livelihood. Most companies endeavor to conduct their operations so as to justify that favorable attitude. But too few of them are adept at dramatizing the facts that furnish a substantial basis for maintaining employee good will. So, where misunderstanding and suspicion born of ignorance exist, time may be required to break down the barriers that have grown up.

The task of telling this inside job to the outside world, however, will not be easy, for two reasons. First, it has been so long neglected that the backlog of misunderstanding is large. Second, public relations involves attitudes as well as actions, a viewpoint as well as an organization. Public relations is not a commodity that can be purchased like a car of coal or a bolt of silk; neither can it be sold by "canned" material. Each program to establish sound public relations must be individualized and indisputably stamped with the personality of the company promoting it. *And the deed must always back the word!*

But the task is worth the effort. For with the inside job right, a properly conceived and intelligently executed public relations program offers business the means of successfully counteracting unjust public suspicion, unfair political attack and unwarranted outside dictation. The need is urgent.



Organizing a Public-

SOUND PUBLIC RELATIONS for an industry starts with a state of mind. There must first be a genuine determination to build an organization which will not wilt under the white light of publicity. When a coal-mining company embarks on a public-relations program, management in effect broadcasts to the world: "We have nothing to conceal; we are proud of our record; our activities are an open book which all who will may read." Every step in the program must justify and further that pledge.

As stated in Part I of this presentation, a public-relations program embraces both an inside and an outside job. The inside job is one of proper employee relations. That job must be broad enough to cover minor executives and salaried workers at the offices and at the mines as well as the numerically much larger group of men actually engaged in producing the coal. While the pattern for this job will vary in details with individual companies, the basic outlines will be the same for all coal-producing organizations.

The Inside Job of the Individual Company

ORGANIZATION for this inside job of developing sound industrial relations involves six major steps:

1. Top Responsibility — A successful industrial-relations program demands the leadership of an able executive with an intimate knowledge of the business of his company, broad human understanding, sincerity of purpose and the ability to make that sincerity and understanding effective in guiding human relations. The men selected to head up this work should report to the chief executive of the company.

2. Clarify Organization — There should be neither mystery nor uncertainty about company organization and functional responsibilities. The lines of authority and company policies should be clearly defined. While some of these responsibilities have been written into wage agreements, many have not. Too few companies, it is feared, have gone beyond such contracts and embodied *all* functional responsibilities, the scope of individual authority and company policies into organization charts and manuals. Such embodiment is an essential step to common understanding and better industrial relations.

3. Improved Personnel Efficiencies —Strengthen those influences within the organization which increase the efficiency of the working force so as to increase the opportunity for the individual and for the company through lower production costs, better service to the customer and improvements in the quality of the product.

4. Assure Well-Being of Employees —More and more enlightened companies are recognizing the importance of safeguarding the physical and mental well-being of their employees. Early isolation of many mining operations compelled management to assume responsibilities that in more accessible communities had rested on the individual. Although good roads and the automobile in many cases have made the company store, the company house, the company doctor and the company school less essential, these facilities and services are still desirable or imperative in a large part of the industry. Where these conditions exist, management should continue its endeavors to further improve and expand these services.

Safer working conditions also are part of this picture. Progressive management will not only meet its legal obligations but will seek to go beyond them in reducing the physical hazards of mining employment.

5. Training — Under the leadership of the U. S. Bureau of Mines, praiseworthy progress has been made in training men for first-aid and mine-rescue work. In many parts of the country, vocational courses sponsored by State universities and coal-mining companies or associations prepare ambitious mine workers for foremen's examinations. Far too little attention, however, generally has been paid to actual job training. Work in this particular field should be intensified. No training which makes for more skilled and safer workers should be neglected.

6. Economic Education — The need for education of the average worker on the economic position of his company and of the mining industry as a whole is paramount. Every international mine workers' convention is faced with hundreds of resolutions from local unions making demands which operators and informed union leadership both know could not be granted without jeopardizing the industry. These resolutions are conceived in ignorance—not in viciousness. They are adopted by the locals because the men who vote for them do not know the basic facts. The job of education is clearly up to management and the educational process must be continuous. Progress probably will be slow because the long years of silence have erected thick barriers of ignorance, misinformation and suspicion.

Some of the steps outlined already have been taken in whole or in part by individual coal producers. To that extent, therefore, their task of establishing sound industrial relations will be lightened. All six steps have the common objective of creating and maintaining real employee confidence in the company and justifiable belief in its determination to merit that confidence. This is the most important part of the "inside job" of public relations. Without complete employee confidence in the sincerity and integrity of the company, management's presentation of basic factual data will fall upon deaf ears.

The Individual Company and the Outside Job

MORE THAN half the battle has been won when internal industrial relations have been placed upon a sound basis. The company then is in a position to tell its customers and the general public not what it aspires or pretends to be but what it is and how it contributes to the national welfare. If the telling of that story increases the sale of the com-

Relations Program

pany's coal, that increase can be set down as an incidental but not worthless byproduct of the campaign.

Fundamentally, however, a public-relations program has a broader objective than a direct increase in the sale of the company's product. In this it differs from an individual or joint sales-promotion campaign. Generally speaking, the latter is aimed to meet a specific competitive situation. While both types of programs seek to build good will, they seek it for dissimilar purposes. In the case of sales-promotional work, good will is sought as the means to the acceptance of a product or a service. A public-relations program woos good will so that the public will not countenance unfair attacks and restrictions which hamper the legitimate functioning of an individual company or an industry.

Coal fascinates most people. Unfortunately, it is a morbid fascination fed on lurid stories of the hardships of mining, the inhumanities of industrial warfare and the horrors of mine disasters. Thousands—possibly millions—of people who never saw a mine have convinced themselves that no man ever becomes a mine worker except under the stinging lash of economic necessity or stays in the industry through choice. Our shortcomings have been well publicized; our good deeds are shrouded in darkness.

A public-relations program may well capitalize on this widespread interest by showing how coal contributes to human comfort and to higher standards of living. Going back to the mines, where popular interest centers, such a program can tell the general public just what actual living and working conditions are. It can tell, too, what is being done to reduce accidents. It also can highlight the hourly rates paid mine labor—exceeded during the first quarter of this year only by the hourly earnings of workers in the construction field. Other data which can be used in this program are set out in Part III of this insert.

In programs for manufacturing industries, great emphasis usually is placed upon the local community public relations. People living in the town in which a factory is located, it is pointed out, judge that enterprise by the things they are told about it and by the part it plays in local community activities. Obviously, where a mine is the only enterprise in a community, cultivation of friendly community relations is merged into the "inside job" of the company. Mine and mining community in those cases are one and inseparable.

Coal-mining companies, nevertheless, have an indirect community-relations job which is an integral part of the broader program. Substantial percentages of the workers no longer live at the mines but reside in near-by larger towns and cities. Many companies have sales or executive offices in cities remote from the mines. These non-resident workers and the distant offices are direct links between the mines and other communities, and the part they play as purveyors of information and participants in local activities help to form the public impressions of the coal-mining industry and of particular companies in that industry. Gossip in Charleston may color public attitudes toward the mines in Logan County; the judgment of Chicago may affect the destinies of mines hundreds of miles away.

How can the mine working through its outside offices participate in the activities of the communities those offices serve? Several ways suggest themselves. Among them are:

1. Close cooperation with the local press and undeviating adherence to a policy of giving out the whole truth and nothing but the truth. Newspapers, like the people who read them, suspect something sinister where facts are withheld. The railroads long ago learned that the easiest way to keep every accident from being magnified into a major catastrophe was to give the reporters prompt and full access to every available fact.

2. Taking part in local civic and business exhibits and expositions.

3. Joining with other companies in disseminating facts which create and maintain public good will.

4. Encouraging local representatives to participate in civic affairs.

5. Discussing company and community affairs with local leaders of thought.

6. Circulating house organs to interested people outside the organization.

7. Presenting facts about the company or the industry before civic organizations, women's, business and luncheon clubs.

8. Showing plant operations by motion pictures in schools and before other groups.

Finally, in organizing the outside community phases of its public-relations program, the mining company must always consider the retail coal merchants in those communities. The retail dealer is the man closest to the domestic consumers. Without his sympathetic and understanding cooperation, any program of the mining industry to tell its story to this important group will bog down. It is imperative, therefore, that the retail coal merchant be tied in with all the public-relations work of the mining company in his community. He can and should be made an active participant in many, if indeed not all, the community public-relations activities outlined in the preceding paragraphs.

The Individual Company and the Industry

NO COMPANY can wholly separate its fortunes from the fortunes of the industry of which it is a part. Neither can it hope to wholly escape if that industry is under the cloud of public disfavor and public distrust. It follows, therefore, that the public-relations program of the individual company will fall short of yielding the maximum beneficial results unless local, State and national operators' associations also are in the picture. Conversely, unless each individual company has done a satisfactory "inside job," its failure to have its own house in order will militate against the complete success of the larger program undertaken by the associations.

Extractive Industries

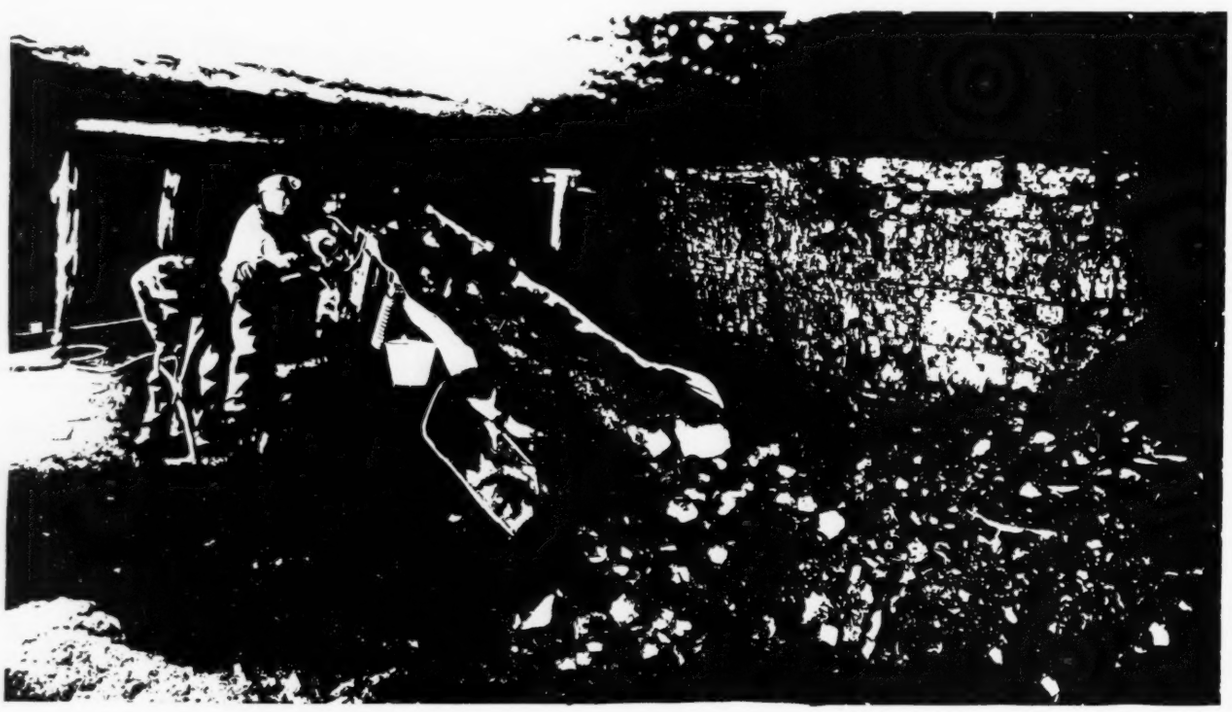
MEASURED in terms of capital investment, value of products or number of workers employed, mining ranks last among the four primary industries of the United States. These conventional yardsticks, however, are not altogether accurate indicators of the importance of mining in our national economy. Actually mining is coordinate with manufacturing, agriculture, and transportation because each of these primary industries is critically dependent upon the product of the mines. Manufacturing draws on the minerals both for its machines and for the power to operate them. The products of the mines constitute nearly two-thirds of the revenue freight handled by the railroads and about one-fourth of the ocean-borne traffic. Even agriculture now leans heavily on minerals for its fertilizers and its implements of cultivation and harvesting. Moreover, minerals are necessary to link the farms with the markets. The products of the mines, in fact, form the material basis for modern industry.[1]

Products of the mining industry (exclusive of natural gas, natural gasoline and petroleum) totaled $3,182,246,000 in value for the year 1935, as compared with $3,451,929,411 gross operating revenue of Class 1 railroads, $8,010,000,000 in crops and livestock, and $45,759,763,000 in manufactured value of the sixteen major classifications of the manufacturing group which includes foods, textiles, paper, chemicals, rubber, leather, stone, clay, iron, steel, machinery and other miscellaneous industries.

Composed of 10,819 metal and nonmetallic mines employing 92,314 men, with 6,665 bituminous and anthracite coal mines employing 565,202 men, the extractive industries employed 657,516 men in 17,484 operations in the year 1935, compared with 994,371 wage earners in Class 1 railroads, 7,378,845 employed in manufacturing, and 12,497,614 family labor and hired help employed in agricultural work during that year. Total average wage earners shown for the four ranking primary industries of the United States at 21,438,346 in 1935, generally excludes professional and clerical workers and those engaged in trade. These groups, as well as forestry, fishing and public utilities—excepting Class 1 railroads—are included in the 40 million workers mentioned in Part I of this insert.[2]

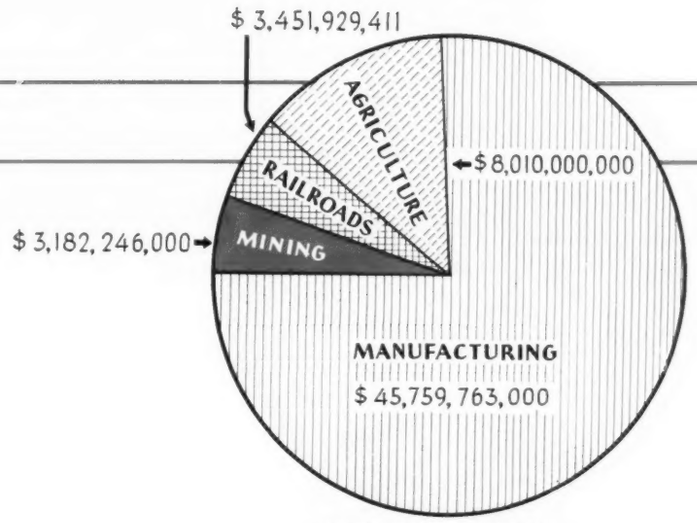
[1] Introduction, 1937 U. S. Minerals Yearbook.

[2] Sources: Statistical Abstract of the U. S., 1937 Edition; A Yearbook of Railroad Information, and the 1937 U. S. Minerals Yearbook. Also bulletin 410, U. S. Bureau of Mines, and compilation of tables from Minerals Yearbook and the U. S. Bureau of Mines.



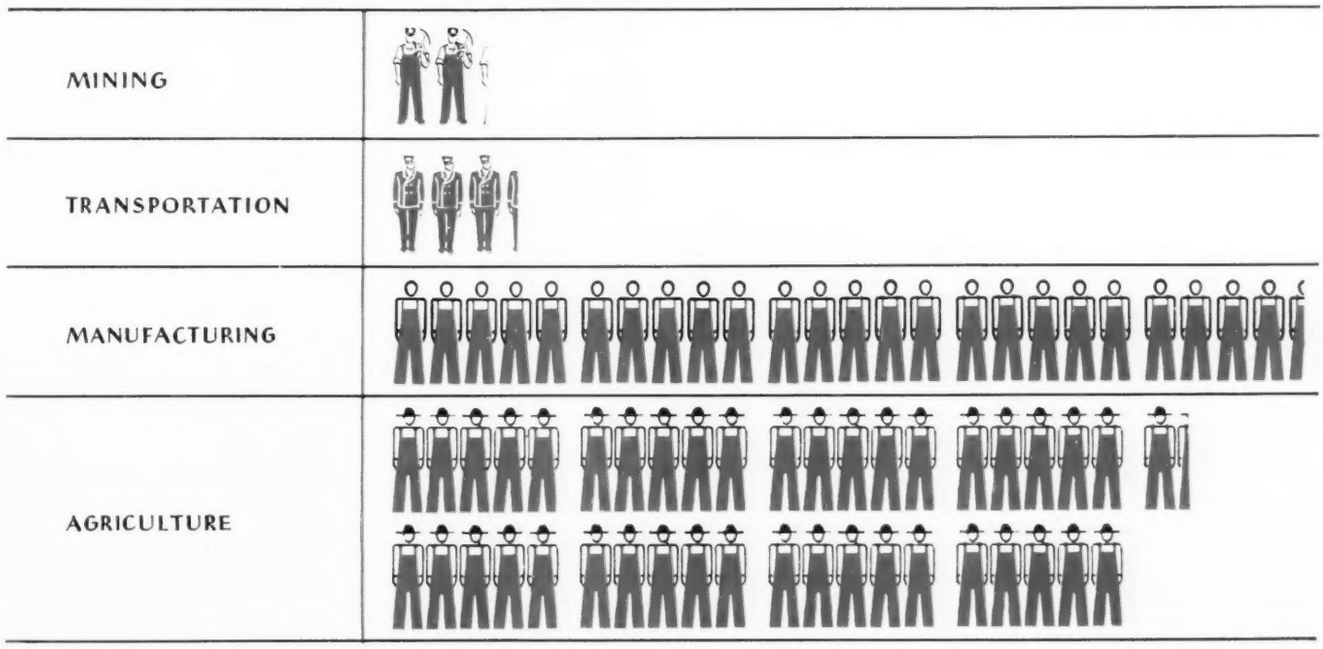
MINING

Ranks fourth in United States primary industries in terms of capital investment, value of products and number of men employed



PRODUCTS VALUE
First four primary industries
Total, $60,403,938,411

MEN EMPLOYED
First four primary industries: total, 21,438,346
Each man represents 300,000 wage earners

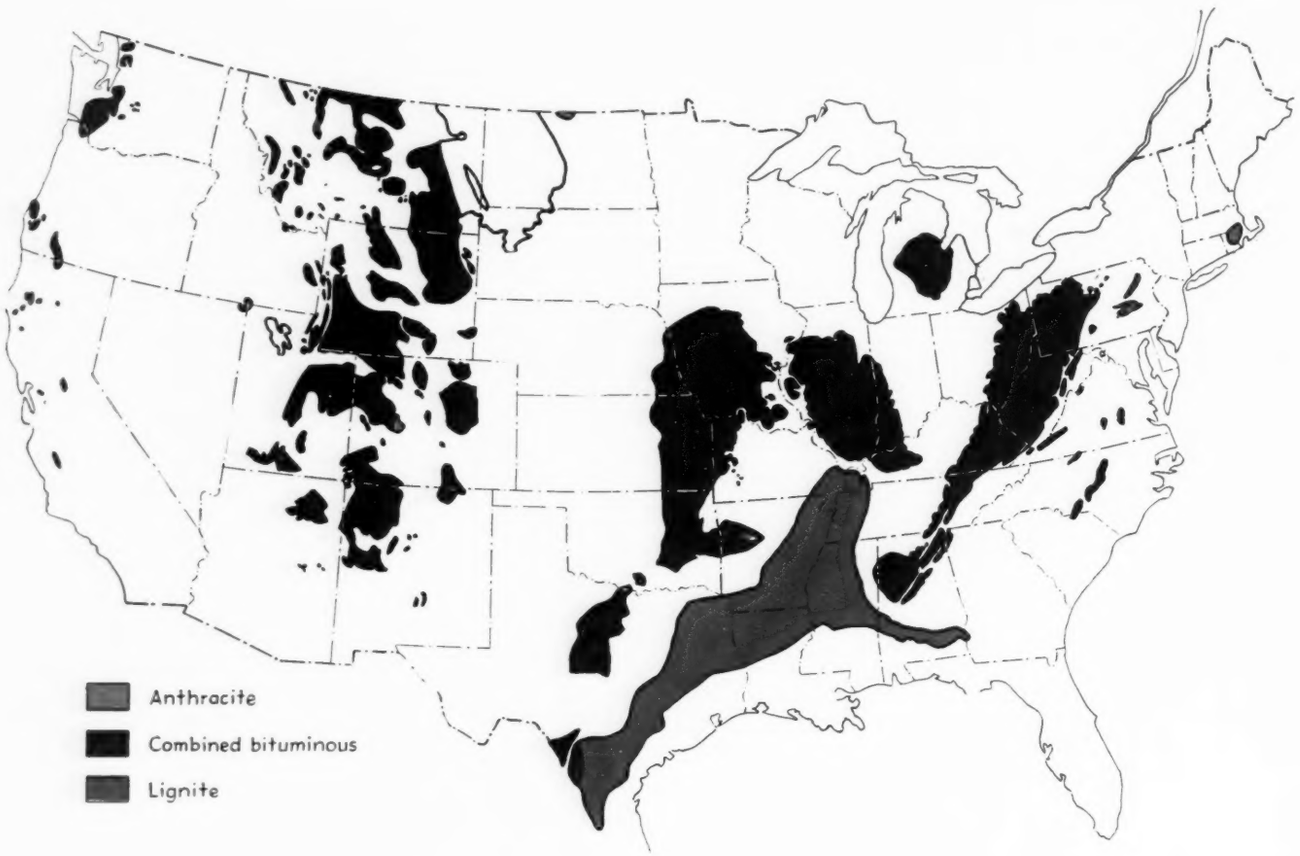


ALL MINING IN 1935

Kind of Mine	Number of Mines	Men Employed: Undg.	Surface	Open-Cut	Total	Product Value
Coal						
Anthracite	350	77,629	20,975	4,244	102,848	$226,000,000
Bituminous	6,315	389,978	63,883	8,493	462,354	$768,000,000
Totals	6,665	467,607	84,858	12,737	565,202	$994,000,000*
Metals						
Copper	94	6,203	2,355	1,630	10,188	
Iron	174	7,691	3,137	3,213	14,031	
Lead and Zinc (Mississippi Valley)	190	5,924	626	178	6,728	
Gold, Silver and Miscellaneous	9,866	32,089	17,543	3,386	53,018	$723,800,000*
Totals	10,324	51,907	23,661	8,407	83,975	
Non-Metals	495	2,498	2,360	3,481	8,339	$1,464,446,000
Metals and Non-Metals†	10,819	54,405	26,021	11,888	92,314	$2,188,246,000*
Grand Totals	17,484	.....	.....	.....	657,516	$3,182,246,000

* Gen. tables, pages 55–58, Minerals Yearbook, 1937 (excluding value of natural gas, natural gasoline and petroleum).
† Table 2, page 6, bulletin No. 410, Bureau of Mines.

Coal Fields



THE COAL FIELDS of the United States are generally grouped into six great divisions known as the Eastern, Interior, Gulf, Northern Great Plains, Rocky Mountain and Pacific Coast provinces. These fields are subdivided into smaller areas called regions, fields and districts, but for purposes of quick picturization they are indicated by broad coal classifications in the resource map on which anthracite (Pennsylvania and other) is shown in red, bituminous (with which is included semi-bituminous and sub-bituminous) is shown in black, and lignite coal in blue.[1]

This same broad classification is used in the table giving estimated unmined coal reserves of the United States at the close of 1936 (as based on Campbell's Coal Resources of the United States and Bureau of Mines report), wherein a regrouping into Appalachian, Mid-Western, Southwestern, Rocky Mountain and Pacific sections combine to total 3,184,441,306,000 net tons unmined. These figures include all known bituminous coal seams more than 14 in. thick, all sub-bituminous more than 24 in. thick and all coals occurring at a depth less than 3,000 ft., but exclude much "possible" coal in many States, the extent of which embraces an aggregate area of more than eighty-nine thousand square miles, and does not include all of the coal in Alaska, Rhode Island and Massachusetts. Deducting total coal mined, plus an estimated wasted-coal tonnage of 30 per cent, slightly more than ninety-nine per cent of known United States coal reserves remained to be mined at the close of the year 1937.

Except for the inclusion of Michigan in the Appalachian division, because it is so treated in the National Bituminous Coal Commission set-up, and North Dakota with the Mid-Western division, this regrouping generally follows orthodox geographic sectionalization. North Dakota, for which no Coal Commission data are available, was arbitrarily thrown into the Mid-Western group to reduce the number of major divisions in this particular presentation. As used throughout these pages, the States in each group are as follows:

Appalachian — Alabama, Georgia, eastern Kentucky, Michigan, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia and West Virginia.

Mid-Western—Illinois, Indiana, Iowa, western Kentucky and North Dakota.

Southwestern — Arkansas, Kansas, Missouri, Oklahoma and Texas.

Rocky Mountain-Pacific — Arizona, California, Colorado, Idaho, Montana, New Mexico, Oregon, Utah, Washington and Wyoming.

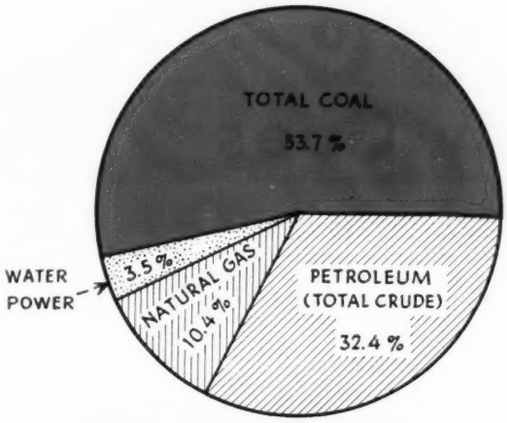
Coal supplied 53.7 per cent of total energy of the United States in 1937,

[1] Keystone Coal Buyers Manual.

with petroleum ranking second at 32.4 per cent; natural gas, 10.4 per cent; and water power, counted at prevailing central-station equivalent, 3.5 per cent.

The consumption of anthracite and bituminous coal in the United States totaled 488,131,000 net tons in 1936 with industrials ranking first as consumers, with 31.45 per cent; domestic heating, second, with 21.01 per cent; Class 1 railroads, third, with 16.95 per cent; beehive and byproduct coke, fourth, 13.51 per cent; utilities, fifth, 9.01 per cent; exports, sixth, 2.52 per cent; used at mines, seventh, 1.22 per cent, with bunkerage and foreign ships ranking eighth, 0.33 per cent.[2]

[2] Minerals Yearbook, 1938.



COAL'S PERCENTAGE OF SUPPLIED ENERGY

Water power counted at prevailing central-station equivalent for the year 1937—Minerals Yearbook

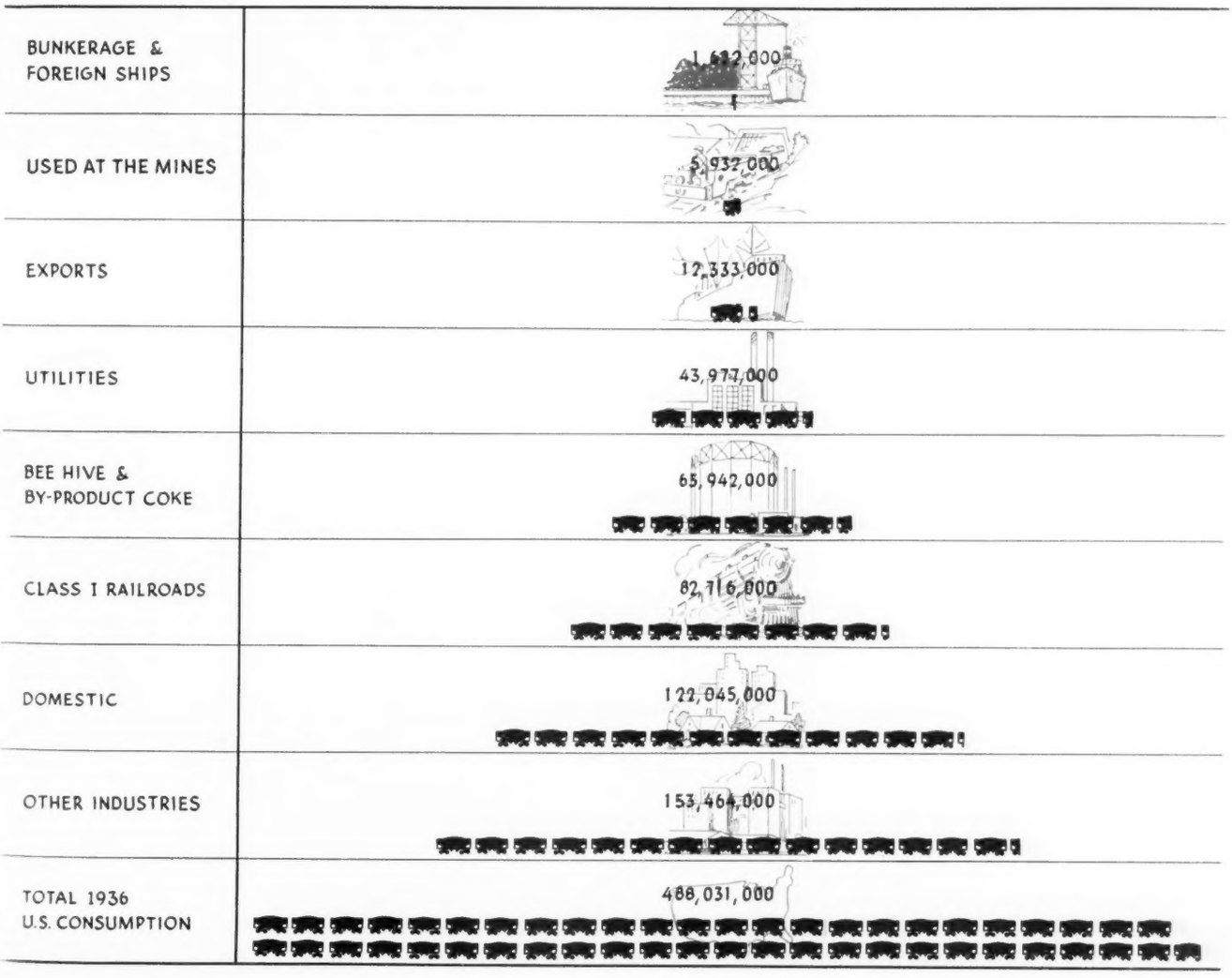
UNMINED COAL RESERVES OF THE UNITED STATES 1936

	Appalachian	Mid-Western	Southwestern	Rocky Mtn. and Pacific
Anthracite (Penna.)	15,560,147	.....	.....	.....
Anthracite (other)	490,595	223,707	.....	93,371
Bituminous (includes semi-, sub.-, and bituminous coals)	467,363,153	279,239,469*	177,518,301	1,182,633,588
Lignite	.....	600,973,404	23,029,186	315,474,133
Totals	483,413,895	880,436,580	200,547,487	1,498,201,092
Grand Total	3,184,441,306,000 net tons†			

* Western Kentucky included in Appalachian.
† Source, Campbell's Coal Resources of the U. S. and Bureau of Mines.

WHO USES COAL

Each coal car represents 10,000,000 tons—year 1936



Where the Money Goes

THE COST of producing, administration and selling coal, as shown by the National Bituminous Coal Commission for the nine months ended December, 1937, in mines of over fifty tons daily capacity, totaled $597,216,818. Of this amount 92.10 per cent was spent on production, 3.06 per cent for administration and 4.84 per cent for selling costs.

Production costs, composed of labor, mine supplies, mine office and other operating charges, totaled $461,241,438, of which labor received $366,777,566; $86,121,316 was spent for mine supplies, including purchased power and mine fuel at market prices, and $23,872,254 was paid in taxes.

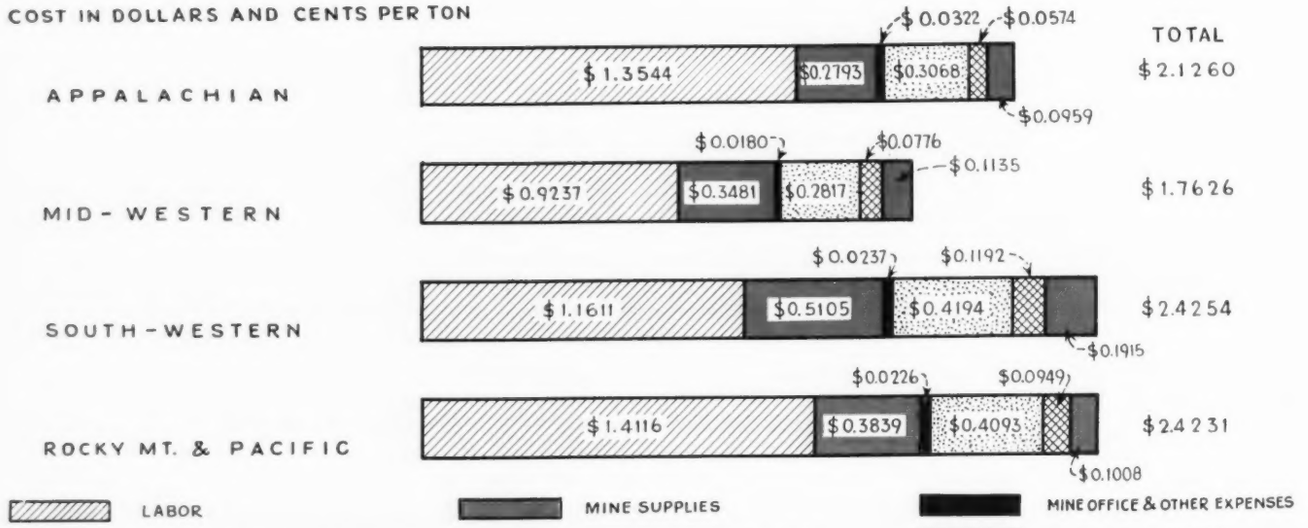
Geographically classified into four general groups for purposes of quick visualization, the Appalachian comprises producing districts numbered 1 to 8 inclusive and district 13; the Mid-Western, districts 9 to 12 inclusive; Southwestern, districts 14 and 15; and Rocky Mountain and Pacific, districts 17 through 23.

These four groups show average total producing, administrative and sales costs ranging from the low of $1.7625 per ton for the Mid-Western, through $2.1260 for the Appalachian, $2.4232 for the Rocky Mountain and Pacific, to $2.4256 for the Southwestern grouping. Of these total costs, $0.9237 per ton was paid for labor in the Mid-Western group, $1.1611 in the Southwestern, $1.3545 in the Appalachian and $1.4116 in the Rocky Mountain and Pacific group.

Total taxes range from a low of $0.0642 per ton in the Southwestern group to $0.0652 in the Mid-Western, $0.0859 in the Appalachian and $0.1113 in the Rocky Mountain and Pacific group; while total mine supplies, including purchased power and mine fuel at market prices, range from the low of $0.2793 in the Appalachian, through $0.3482, Mid Western; $0.3839, Rocky Mountain and Pacific, to the high average of $0.5105 in the Southwestern group for the last nine months of 1937. Comparable data for anthracite are not presented as they are not available.

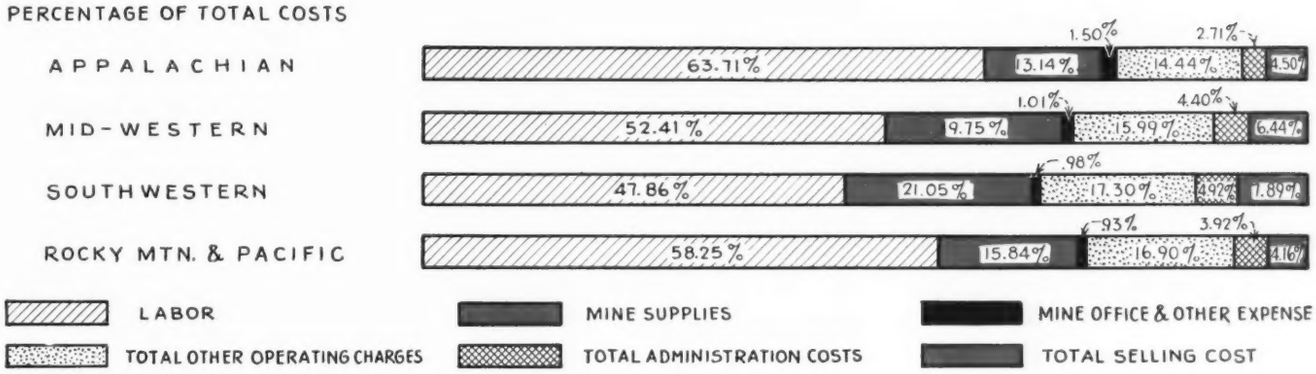
WHO GET COAL'S DOLLAR

Average producing, administrative and selling costs for the nine months ended December, 1937, from National Bituminous Coal Commission statistics, mines producing more than 50 tons a day



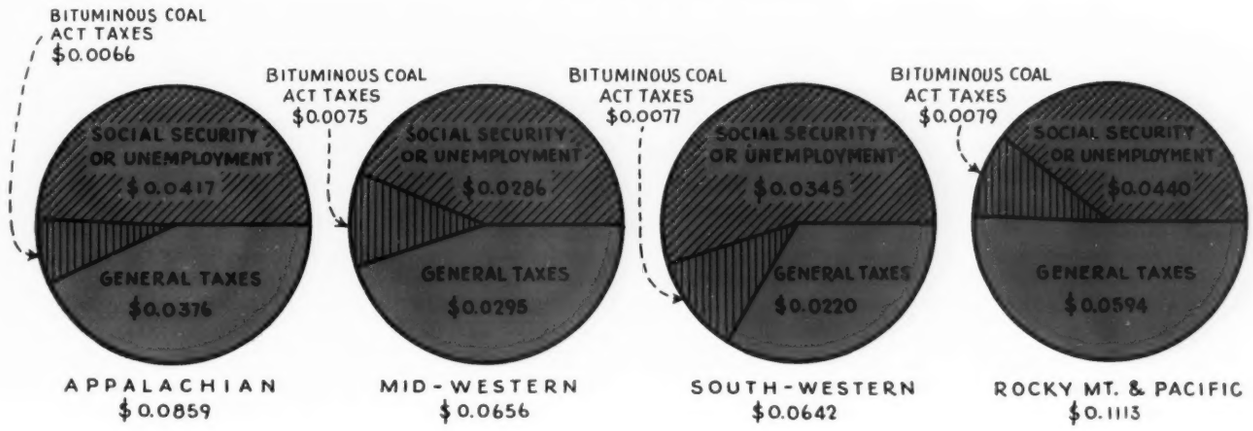
PERCENTAGE PARTICIPATION IN COAL'S DOLLAR

Average producing, administrative and selling costs for the nine months ended December, 1937, from National Bituminous Coal Commission statistics, mines producing more than 50 tons a day



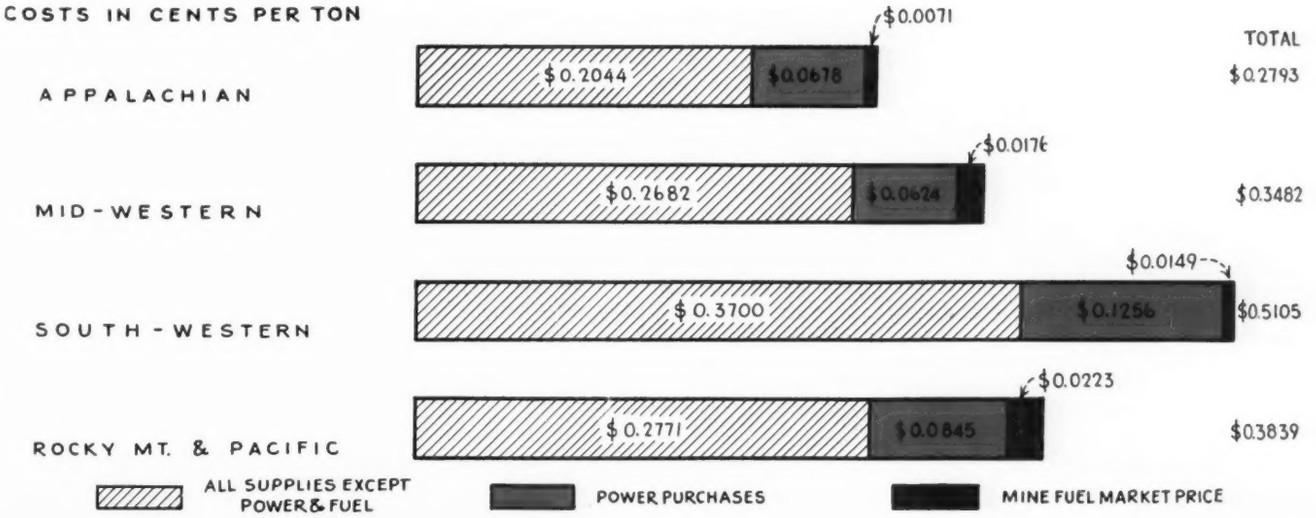
COAL'S TAXES

Average for mines producing more than 50 tons per day for the mine months ended December, 1937, from National Bituminous Coal Commission statistics



OPERATING SUPPLY COSTS

Average for mines producing more than 50 tons per day for the nine months ended December, 1937 from National Bituminous Coal Commission statistics



Lightening the Miner's Task

ALTHOUGH coal mining is still no job for a sissy, many of the arduous tasks commonly associated in the public mind with mine labor have been materially lightened. Other tasks calling for a maximum expenditure of human energy are yielding to improved mining technique and labor-saving machinery. More and more attention is being given to the betterment of working conditions; reduction of occupational hazards is receiving increasing and continuing study; basic wage rates are higher and hours of labor are shorter. These facts should receive constant reiteration and dramatization in coal's public-relations program because too many people outside the industry still visualize the mine worker's job in terms of conditions which existed a hundred years ago.

This lightening of labor began with the first application of steam to pumping problems. The use of machines to add to the power of man's muscles represents a continuous development at an increasing acceleration which has been particularly marked during the past twenty-five years. In 1891, for example, only 5.3 per cent of the coal was undercut by machine preparatory to breaking down the face for loading; ten years later that tonnage had increased to 25.6 per cent of the total output; in 1936, the percentage had risen to 84.8 per cent.[1]

Mechanical loading of coal underground was first tried out in an experimental way about fifty years ago. It was not until 1923, however, that the development reached a sufficiently significant point for the U. S. Bureau of Mines to compile statistics on this trend. In that year, 1,880,000 tons, or 0.3 per cent of the total deep-mined bituminous tonnage, was so loaded. Five years later, the mechanically loaded tonnage had risen to 21,559,000, or 4.5 per cent of the total deep-mined bituminous output. Another five years saw the figure up to 12.0 per cent. Two years ago, the percentage was 16.3, or 66,976,872 tons. Preliminary estimates for 1937 place the total bituminous output so loaded at 83,500,000 tons. Anthracite tonnage mechanically loaded last year is estimated at 10,490,728.

Stripping—another notable contribution to mechanization of mining—had a checkered history during its early years. Since 1911, however, there has been a steady improvement in equipment and operating results. While the tonnage of bituminous coal so produced has remained fairly constant during the past eight years, the percentage of strip output to total bituminous tonnage has increased from 3.79 in 1929 to 6.40 per cent in 1936. The tonnage that year—the latest for which figures are available—was 28,125,857. Further increases in strip tonnage in Illinois and Indiana are indicated for 1937.[2]

The combined anthracite and bituminous production mechanically loaded or mined by stripping in 1936 was 112,309,958 tons. *This was 22.75 per cent of the total output of both classes of coal produced that year.*

Mechanical cleaning of coal has followed the upswing in mechanical loading. The National Bituminous Coal Commission estimates that at least 65,000,000 tons of bituminous coal was so prepared for the market last year. This was an increase of approximately 4,000,000 tons over the total for the preceding year and an increase of 20,000,000 tons over the total mechanically cleaned in 1935. During 1937 and the early part of the present year, new installations added at least 6,400,000 tons to the annual mechanical-cleaning plant capacity in the bituminous fields.

Practically all the anthracite tonnage also is mechanically cleaned and has been so prepared for many years. Moreover, standards of preparation in both divisions of the industry are constantly improving, assuring the consumer a better cleaned and more closely sized product. One of the latest developments in this trend is the increasing number of mines that are specially preparing coal for use in residential-type stokers.

Although the liquidation in excess mine capacity which started in 1924 has reduced the potential capacity of the bituminous mines from the 1923 high of 970,000,000 tons (based on 308-day operation), present reserve capacity is still ample to take care of all known demands and substantial increases. Production in 1936, for example, was 439,087,903 tons and the estimated potential capacity (based on 261-day operation to take care of the five-day week) was 576,000,000 tons.[2] Anthracite capacity also offers a substantial margin of safety over consumptive demands.

The effect of improved operating practices and the increasing application of equipment to productivity is reflected in the long-time trend of the average output per man-day. Back in 1891 this average was 1.98 tons per man-day for the anthracite worker; in 1936, it was 2.79 tons. In 1891, the average output per man in the bituminous fields was 2.57 tons; by 1932, it had risen to 5.22 tons. In the spring of 1934, the hours per work-day were reduced from eight to seven; this was reflected in a drop in average output per man-day to 4.40 tons in 1934. Due largely to increasing mechanization, this average was raised to 4.50 tons per man-day in 1935 and to 4.62 tons in 1936.

The trends in basic wages rates in the anthracite division of the industry have been steadily upward for many years. Except for reductions in the late '20s this also has been true of basic rates in the unionized bituminous fields. Rates dipped more violently in the then non-union areas in the early '30s, but beginning with the Appalachian wage agreement of Oct. 1, 1933, when practically all the bituminous fields became unionized, there has been a steady advance. Since the Illinois mines have been unionized for many years, wage rates in that State probably give the best picture possible of the long-time trend. Going back to 1900, two years after the first Central Competitive Field agreement, hourly rates for tracklayers in Illinois were 23.58c. This moved upward to a high of 93.38c. in 1920 and held at that figure until Oct. 1, 1938, when they diped to 62.5c., rising again in later years to the present basis of 85.7c.[3]

Compared with hourly earning rates in other industries, anthracite and bituminous mining now stand second and third, respectively. Figures for the first quarter of 1938 show that only the construction industries had higher average hourly earnings.[4]

There is a wealth of basic data on the coal-mining industry available. That given here represents only the top picture. Other basic data which can be dramatized in telling the story of the industry, further expansion of the summary material here presented and actual case histories in public relations will be presented in succeeding issues of *Coal Age*.

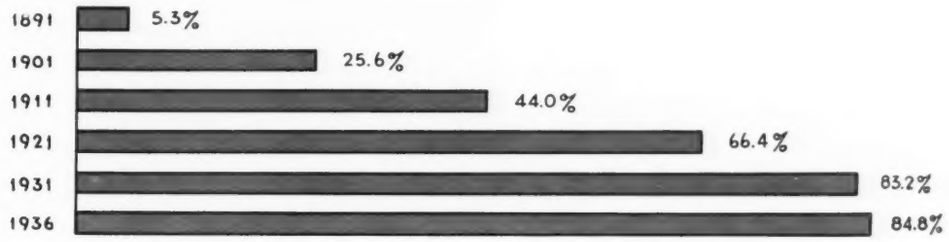
[1] U. S. Bureau of Mines.

[2] National Bituminous Coal Commission.

[3] Illinois union wage contracts.

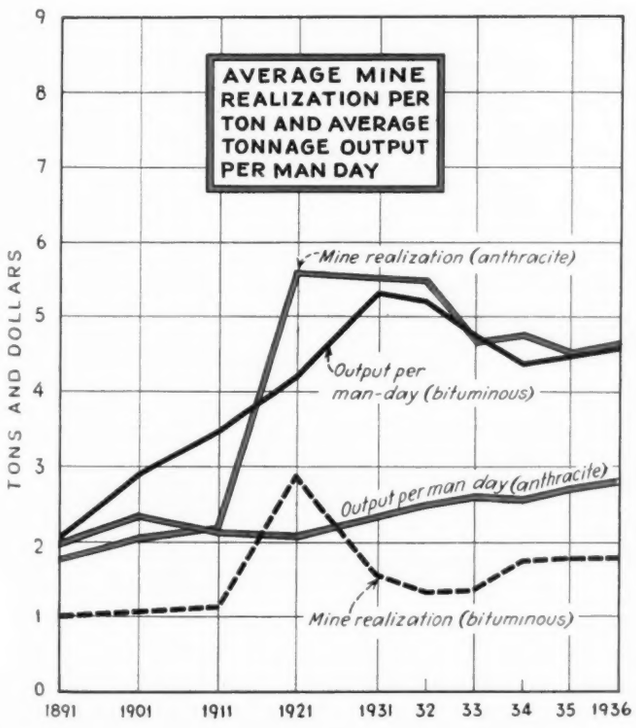
[4] National Industrial Conference Board.

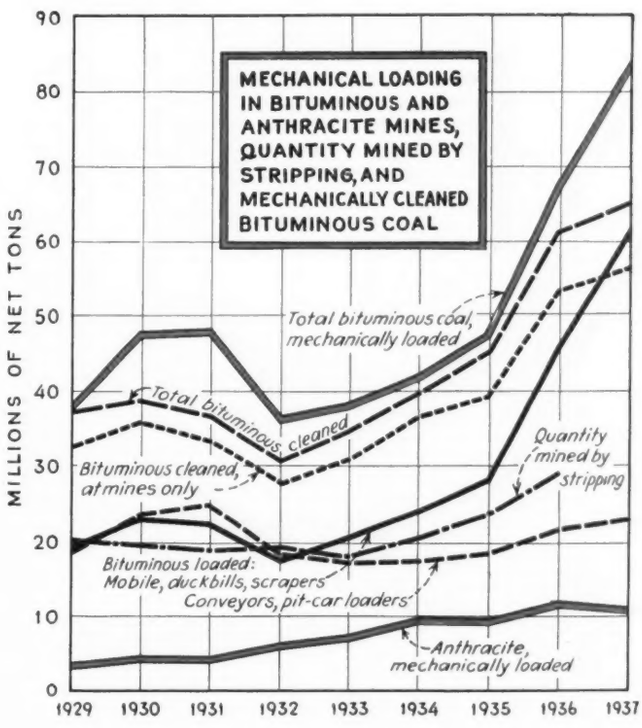
PERCENTAGE OF DEEP-MINED BITUMINOUS COAL PRODUCTION CUT BY MACHINES, 1891–1936



TONNAGE AND PERCENTAGE OF DEEP-MINED BITUMINOUS COAL LOADED MECHANICALLY, 1923–1936

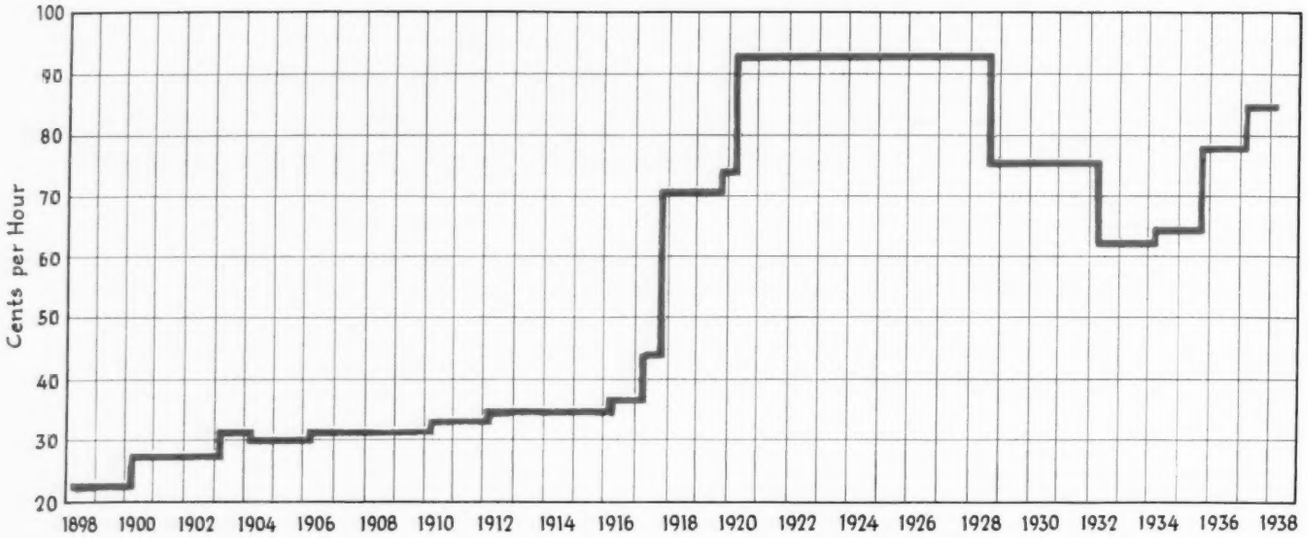
	TONS	
1923	1,800,000	0.3%
1924	3,496,000	0.7%
1925	6,243,000	1.3%
1926	10,022,000	2.0%
1927	NO DATA	NO DATA
1928	21,559,000	4.5%
1929	37,861,000	7.3%
1930	46,982,000	10.5%
1931	47,562,000	13.1%
1932	35,817,000	12.4%
1933	37,820,000	12.0%
1934	41,433,000	12.3%
1935	47,177,000	13.5%
1936	66,962 000	16.3%





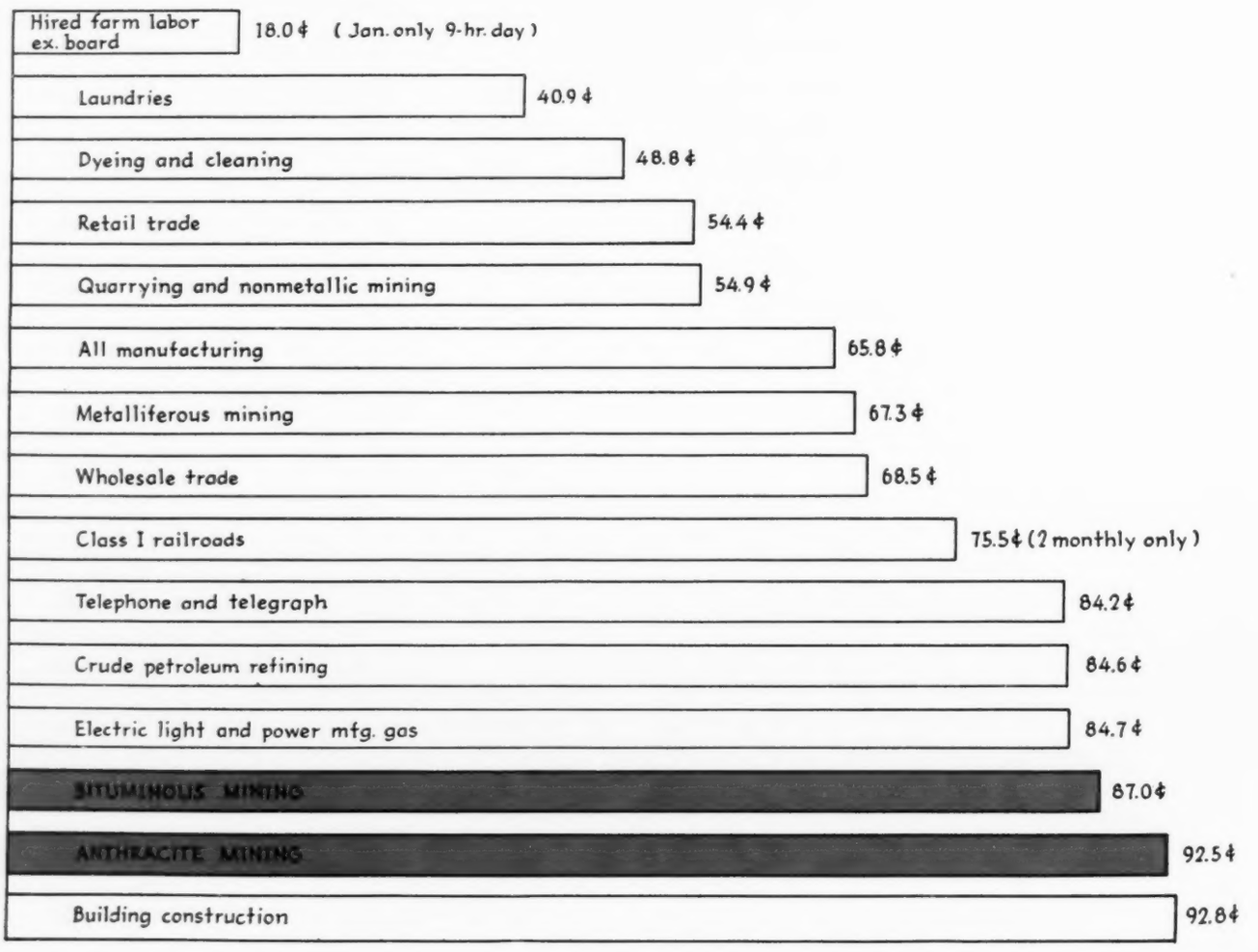
BASIC WAGE RATES IN ILLINOIS

Trackmen



AVERAGE HOURLY EARNINGS, FIRST QUARTER 1938

National Industrial Conference Board

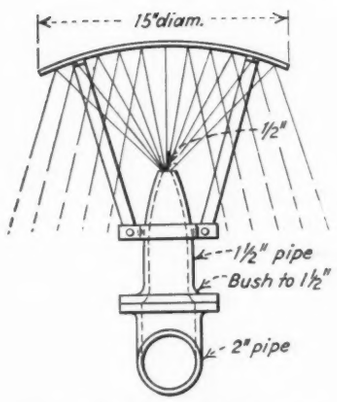


HOW LEHIGH VALLEY + Protects Its Breakers Against Fire Hazard

TO EXTINGUISH promptly any fire that may occur in its Prospect breaker, a frame structure about a mile from Wilkes-Barre, the Lehigh Valley Coal Co. has a 1,000,000-gal. reservoir expressly provided for fire service, which is kept full of Susquehanna River water. Should a fire occur, a pump will deliver this water promptly to sprays in the breaker through a 12-in. column line which carries the water to a point 6 ft. above the top of the breaker.

As the pump, a 10-in. Barrett-Haentjens double-suction volute unit direct-connected to a Terry Type C turbine running at 1,800 r.p.m. with a capacity of 2,500 g.p.m. when operating under 195 ft. of head, is located below the level of the water in the reservoir, it is always full and always operates under an entrance head; hence it can be put in immediate operation without any possibility of failure. Being located adjacent to the boiler house, where employees always will be present should a fire occur, the pump can be started without delay as soon as the alarm is given. When the water is to be used only for testing and not for fire fighting, the water in the column line of the fire-fighting system can be bypassed to the reservoir; thus the pump can be tested without deluging the breaker. Such a test is made to assure the management that pump and line are being kept in condition for immediate service.

From the column line the water is carried by branches and laterals to the various spray heads, of which there are 96, all of the Lehigh Valley Coal Co.'s own design (see line drawing). These consist each of a 1½-in. pipe drawn down to ¾-in. to form a nozzle, over which is placed an umbrella-like distributor to throw the water over a circular area of 20-ft. diameter. About one minute after the pump is started, all sprays are in operation.



Spray head for drenching breaker

As the fire-alarm system is of the "open-circuit" type that operates only when the circuit is closed and not on its disconnection or severance, each of the eight circuits is made independent, so that the failure of any one of them will not put the system completely out of service. The operative can retreat from one station to the next should the first fail to sound the siren. Electrical current for operating the fire-alarm system is provided by an 8-volt dry battery; red indicating globes at each alarm box operate on 32 volts a.c.

Whenever the colliery is idle, night or day, two watchmen make an hourly round of the stations in the breaker, recording their visits on watch clocks. As this breaker, like all others, is high and as inspection involves much climbing of stairs, the breaker is divided into two convenient inspection districts, which each watchman inspects alternately every hour. During the working day, employees are available at all points in the breaker to sound the alarm. When the alarm current is established by pulling down the hook of any alarm box, whether for a fire or a test, it operates the boiler-house siren, notifying an attendant at that point to start the pump immediately. The siren is arranged to blow continuously until checked, so that the attendant cannot fail to attend to his duties.

Five fire companies have been organized and trained, and drills are conducted several times each month.

Prospect Breaker, Wilkes-Barre, Pa.

Monthly reports are sent to the main office from the colliery, giving a complete record of the condition of the system, its several inspections, the number and times of the fire drills and the time which, on each occasion, was required to put the system in operation.

Extinguishers and water barrels with buckets are maintained in all colliery buildings and at fixed points in the breaker. The colliery also is visited periodically by representatives of the Underwriters' Association, who make inspections and tests of the system.

Similar fire-protection installations have been made at the Hazleton Shaft and Spring Mountain breakers of the same company, and they differ only in that the pumps are operated electrically and the motor control is connected to the fire-alarm system so that the pushing of the alarm button not only actuates the siren but also starts the pump. The signal system in these instances is a 32-volt 60-cycle a.c. electric circuit, normally kept closed and so arranged that any break in the circuit is recorded in the boiler house, where there is an alarm and light service to indicate the interruption and indicators to show in what circuit the interruption occurs; hence when the break is made by a fire signal it indicates the particular zone in which the fire has occurred.

Red indicating globes at each box are operated at 32 volts alternating current; each box is connected to the central indicator by a four-wire cable —two wires for alarm and two for supervisory current. When the four wires in the cable are damaged or power fails, no alarm is sounded, for a relay in the supervisory circuit opens the alarm circuit and sounds a trouble signal at the central station. The supervisory relay prevents the spray pipe from starting on a return of power.

As soon as the siren blows, the attendant presses a button marked "siren" to stop the continuous blast and then operates the same button as many times as is shown by the zone number of the indicator, holding down the button each time so that the siren will sound its loudest note. Having repeated the signal three times, with a wait after each signal, the attendant resets the zone number by pushing a rod on the side of the cabinet marked "Reset." To stop the breaker spray pump, a button marked "Stop" is pressed, resetting the system ready for service again when needed.

Because with a closed system an alarm may be given when the circuit becomes grounded or accidentally broken, close supervision is necessary. The breaker-supply pump also may be started by a false alarm or by a return of power after a main-line failure. At the Spring Mountain breaker, two of the zones cover the yards north and east of the railroad and south and east of the railroad, and the circuits of these zones are arranged so that when they are opened they will not start the breaker spray pump. These zones are not provided with sprays but only with fire plugs. Main-line power failure may open the circuits from these zones also and may occur while any one of the circuits is opened. Unless the zone lines are reestablished at the alarm box after the circuit has been opened and unless the station annunciator drops are reset by the attendant after the alarm box is reset, the zone line will be out of commission.

Substantial reductions in insurance rates have followed the replacement of stand pipes and fire hose in the breakers by this more speedy and effective method of fire protection.

DUAL-PURPOSE BOREHOLE

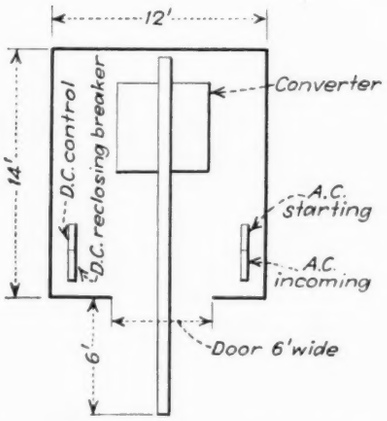
+ Uses Casing as Conductor

In Serving Feeder Circuit

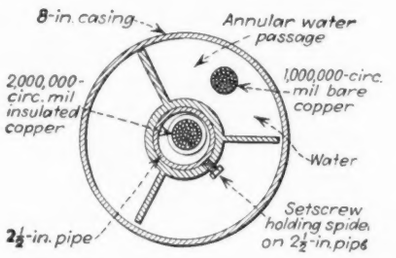
USING a pump borehole casing as a conductor, installing an electrical conduit and a bare copper conductor in the water column and arranging a semi-automatic 500-kw. 275-volt substation in a 12x14-ft. building are unusual features of a mine-drainage and power-improvement job at Stanaford No. 6 mine of the Koppers Coal Co., Raleigh County, West Virginia. No operating difficulties have appeared in the two years since the equipment was put into service.

At a location on 24th Left where the cover is 438 ft. it was decided to install an underground pumping station discharging vertically to the surface and an outside substation to feed direct current down into the mine at that point for general inside purposes. A 200-hp. d.c. motor was available for driving the proposed pump. Since the pump would not be operated long hours except in emergency or extremely wet weather and also because a large converter (500-kw.) was available for the substation, it was decided to utilize the 200-hp. d.c. motor instead of buying a 4,000-volt a.c. motor and putting in the necessary a.c. borehole cable.

The lengths of 8-in. casing were joined by acetylene welding as they were lowered into the borehole. Terminals welded to top and bottom of the completed casing served for connections to cables of 1,000,000 circ.mils, which is the approximate copper equivalent of the 8-in. welded steel casing. Suspended inside of the casing and exposed to the water is



A small building for a 500-kw. 275-volt substation, but with plenty of room for operation and maintenance



Borehole serves as a discharge for a 1,000-g.p.m. pump and as a conduit for a 2,000,000-circ.mil d.c. circuit

a 1,000,000-circ.mil stranded bare copper cable connected in parallel with the casing to form a 2,000,000-circ.mil total copper equivalent negative. Since the water pumped through the borehole contains little or no acid, corrosion was not an important factor in the design.

Inside of the casing and centralized by three-pronged spiders was installed, as the casing was lowered, a 2½-in. galvanized standard steel pipe with ordinary threaded sleeve joints. This pipe serves as a watertight conduit for a 2,000,000-circ.mil rubber-insulated and braid-protected 275-volt d.c. positive cable which is suspended by its conductor.

The five-stage 1,000-g.p.m. centrifugal pump is driven at 1,400 r.p.m. by a V-belt connection from the 1,750-r.p.m. motor. Twenty-four 1-in. belts constitute the drive. Pump bearings, motor bearings and motor windings are protected by thermostats which open the control circuit in case of overheating.

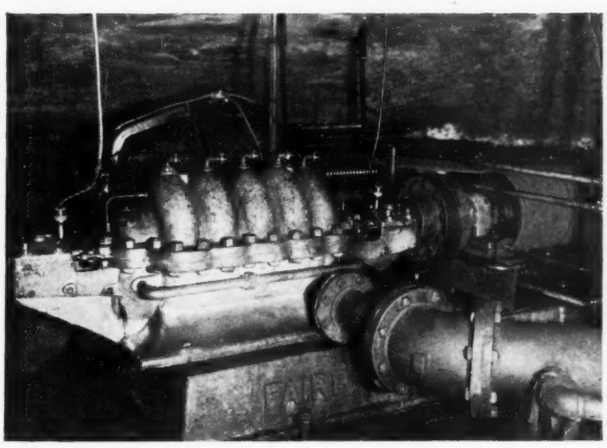
At the surface substation a blower permanently installed in a window opening provides for heavy-load or hot-weather ventilation and an overhead I-beam paralleling the converter shaft and projecting 6 ft. outside of the door provides a safe and convenient means of handling the Type HCC converter or any part of it in case of a maintenance difficulty. Dimensions of this I-beam are ⅜x14 in.x20 ft. long.

The building is a metal-clad wood-frame structure. Alternating-current control and d.c. automatic reclosing breaker panels are installed on the left side of the door and the a.c. starting and a.c. incoming panels on the right-hand side. Secondary leads from the transformers enter the building via a vitrified bushing set low in the wall and directly back of the a.c. starting panel. High-voltage underground cables bring the 4,000-volt power from the pole line to the incoming panel and also carry this power outside to the three 165-kva. transformers which are Y-connected on the high side.

Showing the shielded water discharge and the suspension of the 2,000,000-circ.mil positive cable. Negative cables from substation to borehole are buried in the ground

"A" is the 2,000,000-circ.mil positive line which leaves via a bronze bushing threaded into the flange and connected to the 2½-in. conduit, "B" is the 1,000,000-circ. mil negative connection to a cable of the same size in the water column, and "C" a cable, also 1,000,000-circ.mils, connected to the casing

A 200-hp. d.c. motor drives the pump through V-belts



Only 12 x 14 ft. but houses a 500-kw. 275-volt substation

Notes . . . FROM ACROSS THE SEA

BY HYDROGENATION of coal, oils can be made suitable for use in such diesel-oil engines as are limited in speed to 1,000 r.p.m., and for this result no modification of the present process is needed, declares the subcommittee on coal of the Committee on Imperial Defense of Great Britain (better known as Viscount Falmouth's committee). Quoting the reply of the Imperial Chemical Industries, Ltd., the subcommittee says: Only when doped do such diesel oils become as suitable for use in high-speed engines (such as are used in road vehicles) as diesel oils made from paraffin crudes. However, they are superior to the aromatic oils produced by carbonization processes or to those obtained by hydrogenation if less effective catalysts are used than those available to companies forming the International Hydrogenation Patents, Ltd. A hydrogenation plant could be operated so as to produce equal quantities of diesel oil and gasoline, and the cost of both products would be the same.

In making fuel oil by hydrogenation of coal, care is necessary to avoid the formation of asphaltic solids. About one-third of the output of a coal-hydrogenation plant could be obtained as fuel oil, the remainder being gasoline, or gasoline and diesel oil. As the hydrogen content of fuel oil is low, the latter can be made more cheaply than gasoline.

Lubricating oils, asserted the I.C.I., cannot be made from bituminous coal or tars by direct hydrogenation, but they might be produced by polymerizing the unsaturated hydrocarbon gases made from the gaseous hydrocarbons which are byproducts of the process or by the manufacture of synthetic oils from the light oils made by hydrogenation, via chlorination and condensation, much as lubricating oils are made in the Fischer process from the crude product. However, an estimate of costs or yields by either of these possible methods cannot be hazarded. At present, concludes the subcommittee, the hydrogenation process is best suited to the production of high-grade gasoline.

Again quoting the I.C.I., the subcommittee says that the most suitable fuel for hydrogenation is slack, not only because it is cheap but because the friable coal is the more easily hydrogenable. However, it may be questioned by this commentator whether coal which passes through a slack screen is identical with the most friable. The kerf and shot locations determine in a large degree which of the coal in the seam is the finer as it reaches the surface. In using fine coal as developed by the ordinary mine plant, it would seem best to choose coals which are cut and drilled in the more friable and cleaner material.

Tests have proved that all coal in which the carbon content on an ash-and-moisture-free basis is less than 87 per cent is amenable to hydrogenation, adds the subcommittee, and the coal should have as low an ash content as possible. Cleaning of such coal for processing will cost about 22c. per ton of raw coal purchased. Anthracite and steam coals are not suitable for hydrogenation. Plants should be designed to use coal only, and not creosote or low-temperature tar, because sufficient of these latter materials are not available. The plant should be large enough to produce 150,000 tons of gasoline, for a smaller plant would not be economical. With the increased material costs and all the latest improvements, such plants would cost about $40,000,000 each. The cost of the oil without profit would be 19.4c. per U.S. gallon, if it is expected that the plant expenditure will be written off in ten years, which is necessary because of the improvements likely to be made meanwhile in technique.

Two synthetic processes for the making of oil are available: the Fischer-Tropsch process and that of the Synthetic Oils, Ltd. In the Fischer process one volume of carbon monoxide is converted with the aid of special catalysts into the higher aliphatic hydrocarbons by hydrogenation of the carbon, using two volumes of hydrogen. If coke is used, says the subcommittee, it is treated in a water-gas plant for the production of water gas, which is then converted into "synthesis gas." If coal is used as the starting material, it is first coked in coke ovens in the ordinary manner, and the coke is used to produce water gas. The coke-oven gas is decomposed to help provide the "synthesis gas." Semi-coke and low-temperature-carbonization gases can be used in a similar manner.

But, in order that the main catalytic process may work efficiently, the sulphureted hydrogen and the organic sulphur compounds must be removed separately. The gas is passed through towers containing a catalyst and maintained at a temperature between 392 and 572 deg. F. It is then taken at atmospheric pressure through the main reaction chambers, containing a catalyst for conversion to hydrocarbon products, which chamber is kept at 356 and 410 deg. F. The large quantity of heat generated in the reaction is removed and used. On leaving the reaction chamber, the gas is cooled, condensing the higher-boiling products, and the more volatile products are absorbed on active charcoal from which they are subsequently recovered.

The liquid primary product which forms most of the yield is distilled to produce gasoline, diesel oil and soft or hard wax or it can be cracked to produce mainly gasoline. Thus far no arrangement has been made with the Ruhrchemie A.G., the German owner of the patent rights, for the use of the process in Great Britain.

A plant using the Synthetic Oils process is being built in Scotland, at one of the coke-oven installations of Messrs. Wm. Baird & Co., Ltd. It will produce only 200 tons of gasoline yearly, and will not be ready to begin operations before the end of the year.

In the search for oil, adds the subcommittee, Messrs. S. Pearson & Sons, Ltd., for the Government, sunk eleven boreholes, mainly in the Midlands, and got one small producer in Derbyshire which yields a good quality of petroleum. Under the Petroleum (Production) Act of 1934 four unsuccessful wells have been drilled and others are being sunk. Oil also is being produced in Scotland by distillation of oil shale.

A DIRECT-READING air-velocity meter which indicates on a scale air velocities in feet per minute without the necessity of timing or calculation is the Alnor Velometer, which is in effect a swinging gate meter, says *Sheffield University Mining Magazine* of 1937. The air which passes through the meter actuates a mechanism comprising: (1) a vane to which a pointer is attached, (2) controlling hair springs, (3) a double-pivoted double-jeweled movement, and (4) a magnetic damping system. The mechanism is housed in a 5¼x5⅜x2⅜-in. plastic molded case and weighs about 2 lb. The pointer has a locking clamp and a zero adjustment screw.

A double-range scale is provided, one usually running from zero to 300 ft. per minute and the other from zero to 3,000 ft. per minute. It is made in three forms: a type with a shutter for changing the range, a type with an adjustable orifice to give range selection, and a tube type. An accuracy of 3 per cent of the full-scale reading is claimed.

IN DETERMINING the quantity of inert dust necessary to render coal dust harmless, the coal-dust sample should not be obtained by grinding the entire coal taken from a channel cut in the coal seam, for the fine dust in the mine comes mostly from certain parts of the bed. The section that makes the most dust may be high in volatile matter or low in ash or may have some other susceptibility, or conditions may be reversed, declared Prof. A. M. Bryan, in a paper presented to the Mining Institute of Scotland.

Water is used to hold down dust, he added, whereas inert dust is spread with the purpose that it will rise at the critical moment. Hence, these two precautions act almost enirely in opposition and the effects of the two treatments are certainly not additive. Moisture wets and cakes the incombustible dusts in common use more than it does coal. The quantity of water in any roadway, whether deposited naturally or by artificial application, may be just sufficient to render the incombustible dust in roadway accumulations non-dispersable, or nearly so, but may not have an equal or similar effect on coal dust.

SATISFACTORY service is being rendered at the Kingshill No. 1 Colliery of the Coltness Iron Co., Shotts, Lanarkshire, Scotland, by its sole 45- to 50-hp. diesel locomotive, which has a drawbar pull of 1,280 lb. on high gear at its maximum speed of 8½ m.p.h., according to the annual report for 1936 of E. H. Frazer, divisional inspector of mines of the Scottish Division. Its usual day's performance

is 350 ton-miles in 7 hours, but, if the gradients were more favorable, it could do 500 ton-miles. The load is limited by the inability of the brakes to control safely more than 50 loaded cars on a gradient of 5 per cent.

Although there is a faintly perceptible smell, its fumes, Mr. Frazer declares, are practically innocuous. After the locomotive had been in use for about nine months, the onerous restrictions were lightened by the Mines Department in recognition of the fact that safe operation was possible with less stringent regulations. Schemes are on foot for the installation of diesel locomotives in two new mines, one operating in coal and the other in oil shale. This is the first diesel locomotive in operation in British mines.

R. Dawson Hall

On the ENGINEER'S BOOK SHELF

Requests for U. S. Bureau of Mines publications should be sent to Superintendent of Documents, Government Printing Office, Washington, D. C., accompanied by cash or money order; stamps and personal checks not accepted. Where no price is appended in the notice of a publication of the U. S. Bureau of Mines, application should be directed to that Bureau. Orders for other books and pamphlets reviewed in this department should be addressed to the individual publishers, as shown, whose name and address in each case are in the review notice.

Suggested Procedure for Conducting First-Aid and Mine-Rescue Contests, by G. W. Grove, U. S. Bureau of Mines, T. P. 579. 55 pp.; paper.

Some Results of First-Aid Training of All the Employees of a Mine or Plant, by J. J. Forbes, U. S. Bureau of Mines, I. C. 6957. 13 pp.; mimeograph.

What's Wrong With Mine Safety Programs, by D. Harrington, U. S. Bureau of Mines, I. C. 6958. 9 pp.; mimeograph.

Since Oct. 31, 1911, when the initial national first-aid demonstration was staged at Pittsburgh, the number of penalties for ineptness in performance at such contests has risen from 18 to 117. Most of the penalties are now no longer general, but applicable to the type of injury to be given first aid. Mr. Forbes' circular gives at length those presentations of the value of general training of all employees which he has so incisively but more briefly enunciated at meetings throughout the country. Though President Roosevelt declares that only 10 per cent of the corporations are derelict in their acceptance of public responsibility, Mr. Harrington in his circular asserts that if all the mines of the United States were as earnest and efficient in the prevention of accidents as are a few—possibly 10 per cent of them—accidents could readily be reduced 90 per cent. That is a compelling statement, seeing that none of the 10 per cent can be said to be carrying safety to any ridiculous extreme.

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Coal Measure Rocks: Part I—Classification, Nomenclature and Relative Strengths, by H. M. Hudspeth and D. W. Phillips. Safety in Mines Research Board. Paper No. 98. British Library of Information, New York. 32 pp. Price, 35c.

As are we, the British are realizing that the names for mine-roof materials are extremely loose and vague. This booklet gives the many local names and proposes a classification based on grain size and mineral content.

Fifteenth Annual Report of the Safety in Mines Research Board, 1936. British Library of Information, New York. 130 pp. Price, 65c.

Such a wealth of information is carried in this volume that any attempt to brief it would be painfully inadequate. Relation of water in coal to its explosibility, relative efficacy of rock dusts for prevention of explosions, dispersability of dusts, firedamp recorders, gob fires, automatic control of rope haulage, explosives, mine lighting, coal-measure strata, roof action, weight on packs, supports in safety haulage, derailments, draft gear, noise from compressed-air exhausts, ropes, silicosis, rational analysis of coals, wetting of dust, and many other matters are discussed.

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Hazards of Compressed-Air Jets for Ventilating Gassy Mines, by R. D. Curries and L. L. Naus, U. S. Bureau of Mines. I. C. 6953, 9 pp.; mimeograph.

Compressed-air ventilation, whether from pressure lines, rock-drill exhausts or auxiliary fans, often is supplied only during the working shift or is provided even less regularly. Consequently, in intermediate periods, places fill with methane, and then excessive quantities are moved at one time, especially at the start of a shift, with risk of an explosion in places where such gas travels. Such ventilation merely may churn gas and dust and not expel them.

Sometimes hot safety lamps are held in a blast of compressed air for cooling, and an explosion may occur. Where reliance is placed on compressed air to ventilate a place, and the air has been turned off, when men reenter the place they may ignite gas. Moreover, the air due to a fire in the compressor, receiver or pipes of a compressed-air line may contain carbon monoxide. Furthermore, sparks caused by the static electricity generated by compressed-air jets may ignite gas or dust, especially when used to clean boreholes. Occurrence of such sparks is less likely if the air is humid and cool.

Annual Report of Research and Technological Work on Coal, Fiscal Year 1937, by A. C. Fieldner, U. S. Bureau of Mines. I. C. 6992; 44 pp.; mimeograph.

The early part of this circular deals with the studies into the origin of coal made by the U. S. Bureau of Mines, but does not definitely give any direct explanation of the source of splints—probably because it is too early to venture on any definite conclusion. Other studies into the relation between the fluidification of coal and the character of the resultant coke follow. Several other matters covered in this circular relate to investigations already reported in *Coal Age* in its book reviews, reports of meetings and annual research survey.

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A Statement of Accounting Principles, by T. H. Sanders, H. R. Hatfield and U. Moore, American Institute of Accountants, New York. 138 pp., 6x9 in.; paper. Price, 75c.

This impartial study of the principles of accounting has been prepared for the Haskins & Sells Foundation by three professors, one of whom specializes in business administration and another in law. In some instances they run counter to the principles set forth by statutes and Federal regulations, but the purpose is to lay down rules that it is hoped will be followed in the future by such jurisdictions, authorities, stock exchanges, accountants and others, even though at present the equities are not as generally recognized as they should be. Wasting assets such as minerals and timber seem to have been entirely overlooked by the authors.

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Explosions in Coal Mines, a Comparison Between Great Britain and France, Report by H. M. Hudspeth, Mines Department. British Library of Information, New York. 29 pp. Price, 20c.

For the ten years 1925-34, the French death rate from explosions was less than a third of that of Great Britain; hence this study. In France, declares Major Hudspeth, a high standard of ventilation is set by statute and a low accident rate from explosions is the result.

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Minerals Yearbook, 1938, Review of 1937, U. S. Bureau of Mines. 1339 pp.; cloth. Price, $2.

This publication follows most of the lines of other years but has been shortened in its bituminous, anthracite and coke sections from 168 to 107 pages, largely by the omission of Dr. A. C. Fieldner's article of "Recent Developments in Coal Preparation and Utilization."

In the bituminous section, price trends, production by fields, length of working day, statistics of undercutting machines, stripping equipment, loading machines and conveyors, with sales of same, have been omitted. Arkansas anthracite, formerly coupled with that of Colorado and New Mexico, is accorded separate treatment.

In the anthracite section, exports are excluded, but competitive fuels are given lengthy consideration, with a table of

apparent consumption of anthracite and competitive fuels by principal States in which the former is used. Production of anthracite by counties is here broken down into mechanically loaded and hand-loaded tonnage. The yield-of-coke-per-ton-of-coal table is omitted; price and coke-oven-byproducts references are shortened and the study of byproduct coke ovens owned by city gas companies excluded.

In addition to all these are sections interesting to coal men on fuel briquets and packaged fuel; also on peat.

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The Metallurgical Examination of Colliery Haulage Drawgear, by J. H. Andrew, R. Jeffrey and W. A. Johnson, Safety in Mines Research Board. Paper 100. British Library of Information, New York. 47 pp.; paper. Price, 50c.

Welding of draft gear should be reduced to a minimum by use of shackles, pins and weldless links. These last are formed by punching in a heavy press followed by shaping under dies. By this method of manufacture, the ends of the links which wear and shear can be provided with more metal than their sides. In welding, voids or inclusions of slag should be avoided. Links of over ¾-in. diameter should be side-welded, even though end-welding is easier. Piling in manufacture of wrought-iron gear should correctly related to direction of loading and, after forging the material should be annealed or normalized.

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West Virginia Coal-Mine Accident Costs and Data, July 1, 1929, to June 30, 1934, by C. W. Owings, U. S. Bureau of Mines, T. P. 580. 51 pp.; paper.

Accident incidence in West Virginia, says this publication, is "entirely too high"—on a man-hour basis, about twice that of the neighboring State of Pennsylvania. The direct cost of compensation to the management is at least 3.05c. per ton.

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Use of Reflector Buttons for Danger, Warning, Direction and Safety Signs in Mines, by F. E. Griffith and H. J. Van der Veer, U. S. Bureau of Mines, I. C. 6980. 5 pp.; mimeograph.

Reflector buttons, such as are used on public highways, will throw back the light from a light source. Crystal buttons, most reflective of any, can be seen 1,000 ft.; red buttons, least reflective, 500 ft.; green and amber, medium distances. These buttons are used to protect track and timber crews, electricians, machine crews, and to identify switch throws, runaway switches, fire extinguishers and first-aid stations.

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Dust Hazards and Their Control in Mining, by D. Harrington, U. S. Bureau of Mines, I. C. 6954. Mimeograph.

It is premature, and perhaps always may be impossible, to specify definite maximum concentrations for dustiness which will be harmless to workers, declares Mr. Harrington. No one knows whether dust with 1 per cent silica is or is not more harmful than a dust of 2 per cent, 3 per cent or even 30 per cent. Moreover, some persons may be more affected by dustiness than others, and the effect may depend on atmospheric temperature and humidity. Furthermore, conditions vary from day to day, depending on the kind of rock being drilled or blasted. Coal dust at the face should be kept down by spraying on the cutter bar and on the coal, rather than by rock-dusting because, where 1 or 2 per cent of methane is present, 80 per cent of rock dust would be needed, and the continuance of such a percentage cannot be assured where coal dust is being made and deposited continuously and in quantity. Visibility also is decreased by rock-dusting in room faces.

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Coal Mine Mechanization, Year Book 1938, American Mining Congress. 408 pp. Price, $2.

In this volume are contained the reports of the various committees of the Coal Division, with articles on the trend of coal-mine mechanization and on the status of mechanical loading and cleaning. These are followed by the papers presented at the annual convention and a short description of the equipment exhibited at the 1938 exposition.

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Dust Sampling With the Bureau of Mines Midget Impinger, Using a New Hand-Operated Pump, by J. B. Littlefield and H. H. Schrenk, U. S. Bureau of Mines, R. I. 3387, 4 pp.; paper; mimeograph.

This midget impigner is, of course, for the estimation of dust suspensions and not for the determination of the inertness of the dust on mine-heading ribs, roof and floor.

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Subcommittee on Oil From Coal, Committee on Imperial Defense. British Library of Information, New York. 71 pp., 6x9⅝-in.; paper. Price, 45c.

Discusses position of Great Britain in regard to natural oil supplies, production of oil from home sources (natural petroleum, shale oil, gas industry, coke ovens, low-temperature carbonization, hydrogenation, Fischer and similar synthetic processes), government assistance, aid to employment, technical and industrial development, defense and protection in time of war.

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Generalization of the Reduction of Hours of Work, Part III, Coal Mines. International Labor Office, 734 Jackson Place, Washington, D. C. 223 pp., 6¼x9½ in.; paper, Price, $1.25.

All countries producing a million tons of coal or equivalent heat units in the case of lignite, have submitted data as to the development and structure of national regulation of hours of work, the scope of the regulations, the normal hours of work and their possible extensions; the grounds, authorizations, lengths, remunerations, restrictions, suspensions and supervisions of such extensions. Two regulatory codes relative to working hours in coal mines have been approved, known as the "Conventions" of 1931 and 1935, the second practically superseding the first. In 1936 a code was drafted, applying the general code on the 40-hour week to coal mines, but it failed of the two-thirds majority necessary for adoption. The lengthy final chapter of this book outlines the status of the problem as exemplified by discussions in which the International Labor Conferees participated and by the results obtained in the previous efforts of the International Labor Organization.

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Coal-Mine Explosions and Coal- and Metal-Mine Fires in the United States During the Fiscal Year Ended June 30, 1937, by D. Harrington and W. J. Fene, U. S. Bureau of Mines. I. C. 6986, 22 pp.; paper; mimeograph.

Twenty explosions occurred in 1937 taking 62 lives, and 25 in 1936 taking 38 lives, whereas an average of 28.2 happened in the previous eight fiscal years, involving an annual average of 110.5 fatalities. Twelve of the explosions, causing 53 deaths, were of electrical origin; four of five major accidents were thus originated, and the cause of the fifth, which occurred in an anthracite mine, is unknown. Rock-dusting was used to some extent in at least six mines in which there were explosions, but in three of these, rock dust may have saved 300 lives.

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Sulphuric-Acid Extraction, Methods for Determining Olefins and Aromatics in Hydrocarbon Oils, Optimum Conditions and Concentrations of Acid, by E. H. Fisher and Abner Eisner, U. S. Bureau of Mines. 15 pp.; mimeograph.

Reagents such as 80 per cent sulphuric acid, though effective with the reactive olefins, will not dissolve or polymerize diamylene, cetene and other less reactive olefins; if, however, the sulphuric-acid concentration is increased, the aromatics are attacked, and the olefins and aromatics interact. Silver sulphate or boric acid when added to sulphuric acid increase its effectiveness but introduce other reactions. Olefin determinations with 80 per cent sulphuric acid give best results.

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Some Pertinent Information About Mine Gases, U. S. Bureau of Mines, I. C. 6983, 15 pp.; mimeograph.

Carbon dioxide, says this circular, is a respiratory stimulant and therefore not physiologically inert, although not highly toxic. One half per cent of the gas causes only a slight increase in lung ventilation. Conscious increased respiratory effort comes only with about 3.5 per cent of dioxide. With increase of the number of carbon atoms in the saturated compounds of the paraffin series, physiological activity increases. Though methane has no physiological action, 0.1 per cent by volume of heptane may produce slight vertigo after about 5 minutes. The circular not only describes the gases likely to be found in mines but also resusciation by prone pressure, gas detectors, including safety-lamp caps, and gas conditions to be watched when a fire occurs.

OPERATING IDEAS

From

Production, Electrical and Mechanical Men

Arc-weld Banding of Tires Resumed at Stanaford

Further evidence that building up worn tires by arc-weld does pay if the most suitable method is found is indicated by the fact that after a lapse of several years, tire filling has been resumed at the Stanaford (W.Va.) mines of the Koppers Coal Co. This resumption, after the temporary abandonment of welding, indicates that the earlier conclusion of a definite saving was not just a fancy of a welding enthusiast. Application of a high-carbon steel filler band by hand welding is the accepted method at Stanaford. The technique in securing a close fit of the band is considered a most important factor in the success.

Tires that have not been previously filled are first annealed to soften them for grooving in an ordinary 26-in. x 12-ft. engine lathe with head and tailstock raised to swing 30½-in. material. The bottom of the tire groove for the band is finished by a fine cut to provide a smooth surface for the fit. When tires that were previously banded come back for refilling, the remaining part of the band is routed out in the lathe without pre-annealing.

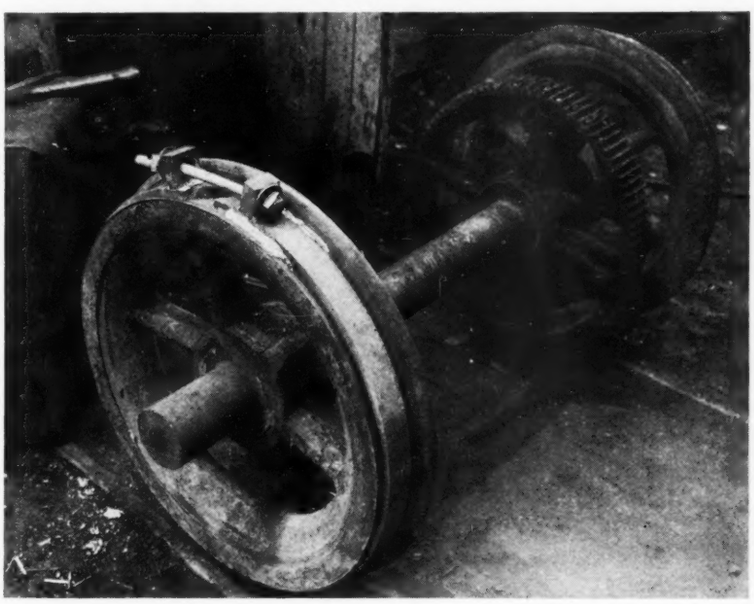
Strips ⅝x2 in. are cut with matching "biased" ends to provide a length which will leave a gap ¾ to 1 in. long when placed on the wheel. After being heated to red in a blacksmith forge and bent around the wheel to approximate fit, the strips are further tightened by a ¾-in. clamping bolt pulling on lugs consisting of 1¼-in. square nuts that have been welded onto the ends of the strip after the initial bending.

The bolt is pulled tight while the band is hot and while it is being hammered gently. During the early stages of the welding the bolt is taken up more if possible. Upon completion of the edge welding, the bolt is taken out and the 1¼-in. nuts are removed by hammering and by cutting with a gas torch or by the gas torch alone. Then the gap is filled by arc-weld.

Four beads all around, which means two layers along each edge, completes the circumferential welding. Tires are not preheated before welding and no annealing is done after welding. Very little final machining in the lathe is required because the top of the filler band is a circle running true with the wheel center.

Actual welding time for a 27-in. tire is 2½ hours. Banded tires wear as well as new ones

Temporary lugs and a tension bolt insure a tight fit for the band. Two 6-in. lengths of first-layer welds have been applied.



Fleetweld No. 5 5/32-in. coated rod is used for the bottom layer or bead, so as to secure a strong weld between the bottom edge of the band and the tire. The upper or finish layers of these circumferential welds are made with ¼-in. diameter of the same quality of electrode and, therefore, are applied faster. The gap space between biased ends of the filler strip is filled with Wearweld ¼-in. coated electrode which is designed to produce a surface of hardness comparable to that of the filler band. Antag special tire steel is used for the bands.

Operator's time for arc-welding a wheel of 26- to 27-in. diameter is 2½ hours. No tire breakage has occurred when following the welding methods of the foregoing description. Only the gathering locomotives operate with these arc-weld banded tires.

In order that remainders of worn bands will not fray out to form a rough and dangerous tread the trucks are removed from service for rebanding after ½ in. of wear; that is, when ⅛ in. of band thick-

ness remains. As to wearing qualities and traction, so far as can be determined, the banded tires give the same service as new tires, which, of course, is to be expected because the steels are the same.

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Wooden Blocks Placed on Cars Identify Coal on Table

At a bituminous mine in Pennsylvania, wooden blocks placed in the mine car with the coal serve to identify the product when it reaches the picking table. Thus when the pickers detect an undue quantity of impurity, the management is informed of the name of the man who did the loading.

The blocks are white pine cut ¼x5x8 in. As a car is delivered to the cross-over dump the man who removes the brass check notes the number, then marks this number with white chalk on a wooden block and places the block on top of the coal. These blocks are dumped with the coal and they ride over the shaker screen with the lump and normally appear on the picking table at a point about midway of the spread of coal from that car. As a rule a dividing line between coal of succeeding loads is discernible on the picking table.

This mine loads principally locomotive and steam-plant fuels; therefore much of the product going over the picking table is mine-run or a size range from which only the slack has been removed. Because the shaker screen beds the smaller sizes under the lump on the picking table, the wooden blocks are always in sight and the pickers readily find and remove them. These recovered blocks are sent back up to the dump house. The dumper erases the old number with his canvas glove or with a rag before chalking on the new number.

At this particular mine the use of identifying blocks has saved the cost of installing an inspection table under the dump and also saves the wages of an inspector. Moreover, the findings of several men working on the picking table should have more weight than a report from a single individual. The latter may easily fail to notice an undue quantity of impurty in a certain car, but some one of a "committee" of several pickers would be sure to notice it.

After removing the check the dumper marks that number on a block of wood

The numbered block of wood goes through the dump, over the shaker screens and onto the picking table with the coal from that car

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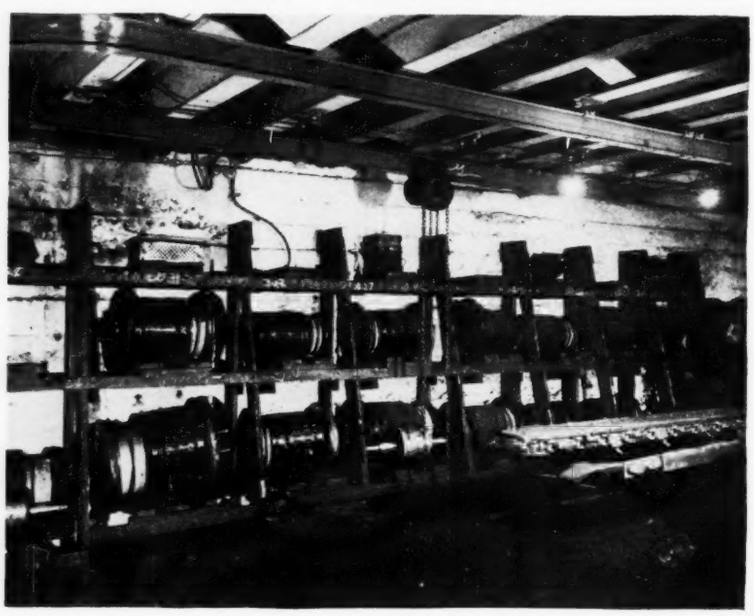
Rack and Monorail at Valier Ease Armature Changing

A complete set of armatures is kept in the underground shop on the shaft bottom at the Valier (Ill.) mine of the Valier Coal Co. To facilitate storing and handling armatures and changing damaged units for new, a rack and monorail track with chain block have been installed. The rack, as shown in the accompanying illustration, is built on a slant to facilitate getting the armatures into and out of their respective compartments, which is done with the assistance of the chain block. With this block, an armature may be picked up, and then while suspended the hoist may be run around over the machine on the monorail track and the armature lowered into place. As the monorail track is continuous in the form of an oval, the block may be moved to any point in either direction.

Armature-storage rack, chain block and monorail track in Valier underground shop



Variety

With coal mining essentially a matter of handling large quantities of a bulky material, taking it from beneath the earth, preparing it for use and loading it for shipment, this activity presents a variety of problems, many of them changing rapidly. Consequently, mining men necessarily turn their hands to many tasks, requiring a rather diversified knowledge of a number of subjects. Research and experimental work by operating, electrical, mechanical and safety men constantly is revising or adding to the fund of knowledge available to mining men, and it is the function of this department to present selected examples of such efforts so that all may have them available. It is a cooperative job, however, so we solicit your findings in the fields of short cuts to improved efficiency, lower cost and greater safety. If you have an idea you think is good, send it in, along with a sketch or photograph if it will help to make it clearer. For each acceptable idea, Coal Age will pay $5 or more.

HAZARD

MINING MACHINE CABLE

Hazacord Twin Flat Mining Machine Cable (All-rubber Construction), consists of two tinned, flexible, copper conductors, individually insulated with high grade rubber compound and covered with a single braid. The two conductors are then laid parallel and covered overall with an outer jacket made of exceedingly tough rubber, reinforced with seine twine. The smooth finish of this jacket excludes moisture and dirt, is not appreciably affected by oil, grease or acid, and is practically proof against wear and tear. Hazacord cable is economical by reason of its long life and uninterrupted service.

HAZARD INSULATED WIRE WORKS

DIVISION OF THE OKONITE CO.

WORKS: WILKES-BARRE, PENNSYLVANIA

New York Chicago Philadelphia Atlanta Pittsburgh Buffalo Boston Detroit
Seattle Dallas Washington San Francisco St. Louis Los Angeles

Magnet Designed for Use On Pan or Scraper Booms

The problem of installing a magnet on a pan- or scraper-type loading boom to remove tramp iron from the coal as it is being loaded has been solved successfully at the Kings Station mine of the Princeton Mining Co., Princeton, Ind. Some construction details are given in Fig. 1, while Fig. 2 is an installation picture showing how the magnet with its guide and redirecting plates is mounted on the end of a pan-type loading boom.

One of the secrets of the installation, according to the men at the mines, is plenty of iron to obtain the maximum magnetic flux. Consequently, the heaviest possible channels and I-beams were used in the magnet frame, with other iron in proportion. One side of the magnet frame is made of an I-beam, while the other side is made of a channel with one leg cut off and replaced by a brass angle. As indicated in Fig. 1, the coal flows down over the top of the magnet, where any iron present is arrested. As the flux is weak at this point, due to the gap shown in the sketch, which may be varied to vary the strength of the flux, the iron gradually moves down onto the face of the magnet, finally ending on the lower edge, where the flux is the strongest. Determination of the various operating conditions is at best a matter of cut-and-try, experience has shown.

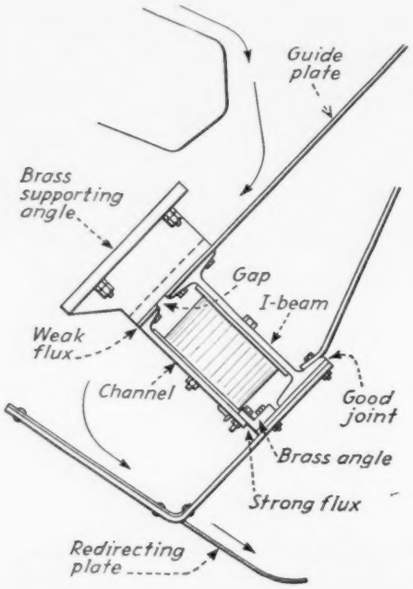


Fig. 1—Diagrammatic sketch of magnet used on pan-type loading booms, Kings Station mine.

The magnet, as shown in Fig. 2, is mounted on the end of the boom frame, using heavy brass angles. A guide plate directs the coal across the top of the magnet, after which it falls onto a second plate, which changes its direction to normal for loading. The redirecting plate, as indicated in Fig. 2, is made with fingers to let the fines drop through first and thus cushion the fall of the coarser coal and prevent segregation.

Kings Station also employs a Dings magnetic pulley for removing tramp iron from screenings before they enter a re-screening plant. Originally, this pulley

Fig. 2—Showing magnet in place on end of boom, together with guide plate for routing the coal across the top of the magnet and a redirecting plate with fingers for loading.

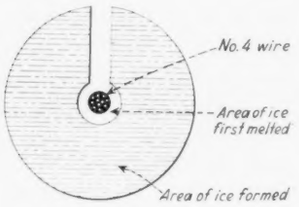
was equipped with a gear drive. Chatter and vibration growing out of this gear drive made daily brush renewals necessary, in addition to frequent renewals of collector rings. This situation was remedied in very simple fashion by moving back the jack shaft and putting in a V-belt drive, which stopped all abnormal wear and deterioration of brushes and rings.

Arched Cover Protects Timber Supply

Timber supplies stored out of doors are protected at operations of the Hudson Coal Co., Scranton, Pa., by arched metal covers, the Hudson organization being the first to adopt this particular type of protection. Made of 16-gage galvanized "Armco Ingot Iron," the cover is 30 ft. long with a span of 12½ ft. and a rise of 6 ft. 5½ in. in the arch. To increase storage space, the cover was erected on eight uprights made of 4-in. pipe, which were notched at the top to take a 20-lb. scrap rail, flange upward. The corrugated sheets were bolted to a 3 x 3-in. angle, in turn bolted to the rail. The flare at the bottom of the corrugated sheets was made of flat galvanized sheet bent outward to shed water.

De-Icing of Power Lines Done by Electricity

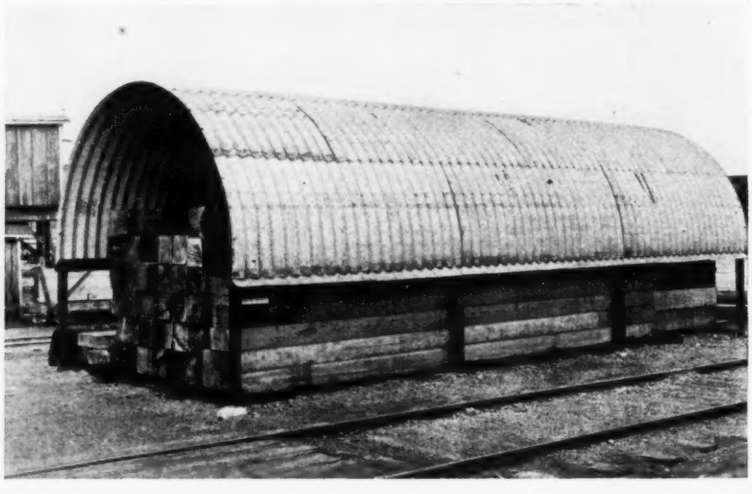
Following a sleet storm on April 8, one of the worst ever experienced in the section, ice formed on the Gallitzin Electric Light Co.'s wires, at Gallitzin, Pa., to a diameter of 4½ in. Wires were breaking down everywhere and the entire town was without light or power one night. The



The heated wire first melted out a hole in the center of the ice and then cut a slot to the top

next day the storm abated, but it continued cold and the ice hung on, rendering reestablishment of service seemingly impossible. As a result, J. F. MacWilliams, Johnstown, Pa., electrical engineer for the Pennsylvania Coal & Coke Corporation, which operates the Gallitzin Electric

Arched metal timber cover used by the Hudson Coal Co.



Light Co., conceived the idea of melting the ice off with electricity.

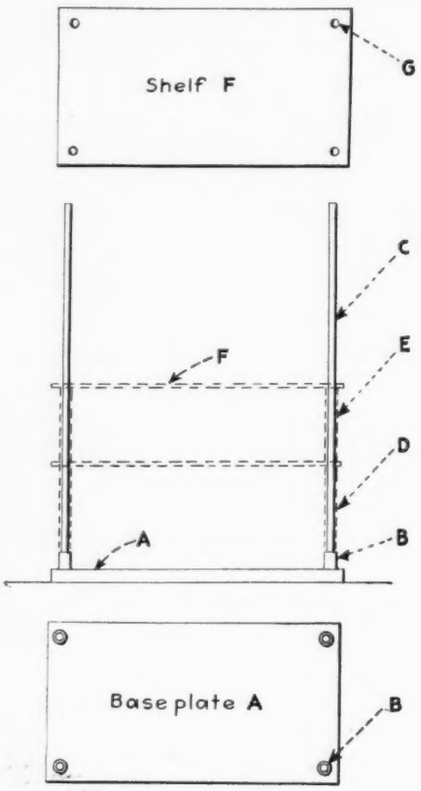
Two large transformers, 50 and 25 kva., were secured and work was started at the point where the Gallitzin Electric Light Co. tapped into the Penn Central's lines, which still were alive. The 50-kva. transformer was fused for 120 kva. and the 440-volt leads were tapped onto two of the main No. 4 wires feeding the town. The other ends of the wires, 1,500 ft. away, then were short-circuited and power was applied. The ice started to melt in a few minutes and in ten minutes the lines were clear. The third wire then was tapped in and thawed in the same manner. During this time, the 25-kva. transformer, fused to 60 kva., was being used to thaw 2,600 ft. of No. 6 line feeding the main section of town.

Above, ice-covered wires sagged almost to the breaking point; below, a line partially thawed by electricity

Melting of the ice took place in a somewhat unusual manner, as shown in the accompanying sketch. A round place first melted out in the center, loosening the ice, which then thawed in a slot straight to the top, dropping off in pieces 6 in. to 10 ft. long. Another unexpected result was that as the lines were cleared the excessive sag (almost to the breaking point) shown in the accompanying illustration almost entirely disappeared. This same method was used throughout all the company's main lines.

Adjustable Features Added To Portable Shelving

A method of making a set of shelves which are adjustable for different types of storage or service is offered by John E. Hyler, Peoria, Ill. These shelves, Mr. Hyler states, can be readily made by the use of a baseplate and pipe, plus the material needed for the shelves themselves.



Details of adjustable shelf set

The baseplate, *A* in the sketch, may be a piece of plate steel or a casting, preferably the former. Four pipe couplings, *B*, are welded at the corners, as indicated. Four threaded pieces of pipe, *C*, are screwed into these couplings, both pipe and couplings, of course, being of a size consistent with the load to be borne on the shelves. Spacer pipes, *D*, then are slid down over the original pipes. A shelf then is placed on the spacer pipes, whereupon the process of adding spacer pipes and placing shelves is repeated, until the desired number is secured.

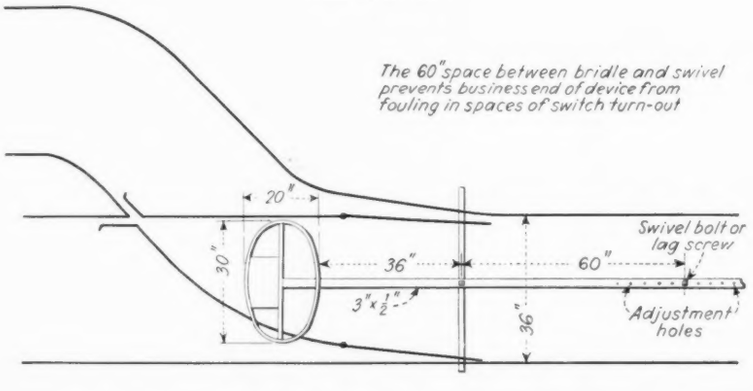
Length of the spacer pipes determines the distance between shelves and, if desired, a number of lengths of spacers may be kept on hand, making height of the shelves adjustable at will. Shelves may be made of metal or plywood, depending upon the service, with four holes drilled or cut in them with a torch so that they will slide down over the pipes at each corner of the baseplate. If desired, the baseplate may be made the top member of a skid or truck for greater mobility.

Automatic Switch Throw Helps in Car Caging

Hand operation of the switch on the loaded side of the cage on the shaft bottom at the No. 53 mine of the Peabody Coal Co. has been eliminated in favor of automatic operation by means of the device shown in the accompanying illustration. Details are furnished by Alex H. Bennett, Springfield, Ill. Prior to the installation of this device, remarks Mr. Bennett, the operation of the bottom was on the "faith-and-prayer system, using scotch blocks and much dexterity, with cars consequently nose-diving into the sump when faith was low or something." The coal trip was blocked outside the switch, which is approximately 20 ft. from the cages, the blocker releasing one car at a time, scotching the trip and throwing the switch by hand at the same time.

Under the present system, the wheels operate the switch as the cars drop down toward the cages. Essentially, the automatic thrower consists of a 3x½-in. flat steel drawbar section to which is attached an ellipse with a greater axis of 30 in. and a lesser axis of 20 in., although these measurements can be adjusted to suit conditions. Adjustment holes are drilled in the drawbar every 2 in. near the end opposite the ellipse. This drawer, as shown, is held to a tie back of the switch by a swivel fastening and also is bolted to the switch bridle. Distance between bridle and swivel is 5 ft. Distance from the bridle to the ellipse is 36 in., also the track gage. As can be seen from the illustration, the car wheels striking the ellipse cause it to move from side to side, throwing the switch automatically. Each edge of the ellipse should extend over the rail, when it is on that side, approximately the distance the latches open. Adjustment of this distance is possible by means of the holes in the drawbar.

Showing diagrammatically how the automatic switch thrower is applied and operated



WORD FROM THE FIELD

P. & R. Reorganization Plan Urges Sweeping Changes

A proposed plan of reorganization whereby the Philadelphia & Reading Coal & Iron Co. would be permitted to dispose of nearly three-fourths of its anthracite acreage, close five mines, terminate two leases and borrow $2,500,000 for additional working capital was recommended on Sept. 15 to the Federal District Court at Philadelphia, Pa., by Howard Benton Lewis, special master in proceedings designed to bring about a new set-up. The plan, according to Mr. Lewis' report, would produce economies of $4,000,000 annually.

It is proposed, among other things, that the company retain only 31,000 acres of land (out of about 154,000 acres owned in fee) and abandon operation of its self-owned Bear Valley mine, near Shamokin, and the Brookside mine, near Tower City, as well as discontinuing operation of three leased properties: the Hammond mine, near Girardville; Gilberton mine, near Gilberton, and the West Shenandoah mine, near Shenandoah (see *Coal Age*, August, p. 60). It was suggested, however, that the company withdraw its petition for termination of Girard Estate leases.

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Pittston Co. to Cut Down Anthracite Activities

The Pittston Co., Scranton, Pa., producer and distributor of anthracite, under a proposed plan of reorganization, is to release its hold on its large hard-coal properties in Pennsylvania and confine its activities to the distribution of fuel. It will curtail its distribution of anthracite and concentrate on the sale of low-volatile bituminous coal. A committee of Pittston directors appointed to carry out the proposed reorganization comprises R. R. Young, Harvey D. Gibson, president, Manufacturers Trust Co., New York; W. E. Lewis, president, Second National Bank of Wilkes-Barre, Pa., and Joseph T. Routh, a New York coal man.

Formed in 1930 by the late O. P. and M. J. Van Sweringen, the Pittston Co. leased lands estimated to contain 97,000,000 tons of coal from the Erie Railroad, an important unit in the Van Sweringen rail system. It then obtained control of Pattison & Bowns, which had distributed Erie coal in the New York area for many years, and likewise the United States Trucking Corporation, owner of a large fleet of trucks here. Distributing organizations in Boston and Chicago also were acquired.

Financial difficulties caused the Pittston organization to transfer 381,250 of its shares to the Chesapeake & Ohio Ry., another Van Sweringen unit, for $7,687,300, and the latter subsequently lent $2,050,000 to Pittston. It is proposed by Mr. Young and his associates to satisfy this

indebtedness through issuance of a new Class A Pittston common stock. Five million dollars of 6 per cent Pittston debentures held by the Erie R.R. will be converted into a like amount of common bonds. The company will disaffirm its lease from the Pennsylvania Coal Co., an Erie subsidiary, covering the Pennsylvania collieries, some of which are inactive and some subleased to independent operators. Operation of the Sheridan-Wyoming Coal Co. in Wyoming will be continued for the present.

Keeping Step With Coal Demand

Bituminous Production

	1938 (1,000 Tons)	1937* (1,000 Tons)
August 6	5,810	7,430
August 13	5,994	7,691
August 20	6,270	7,669
August 27	6,476	8,018
September 3	6,875	8,500
Total to September 3	205,367	292,762
Month of August	**28,280**	**33,988**

Anthracite Production

August 6	546	435
August 13	428	558
August 20	417	483
August 27	688	761
September 3	925	845
Total to September 3	29,628	33,658
Month of August	**2,774**	**2,903**

* Outputs of these two columns are for the weeks corresponding to those in 1938, although these weeks do not necessarily end on the same dates.

Bituminous Coal Stocks

	(Thousands of Net Tons) Aug. 1 1938	July 1 1938	Aug. 1 1937
Electric power utilities	8,147	8,067	8,523
Byproduct coke ovens	5,364	5,000	7,433
Steel and rolling mills	652	716	1,485
Railroads (Class 1)	4,482	4,827	7,195
Other industrials*	8,812	9,002	12,355
Total	27,457	27,612	36,991

Bituminous Coal Consumption

	(Thousands of Net Tons) July 1938	June 1938	July 1937
Electric power utilities	3,082	2,846	3,843
Byproduct coke ovens	3,085	2,931	6,281
Steel and rolling mills	583	588	1,042
Railroads (Class 1)	5,471	5,298	6,759
Other industrials*	6,674	7,233	9,870
Total	18,895	18,896	27,795

* Includes coal-gas retorts and cement mills.

Coal Men Protest Extension Of Coal-Rate Boosts

In replies filed during the closing days of August with the Interstate Commerce Commission, John Carson, Consumers' Counsel of the National Bituminous Coal Commission, and the National Coal Association requested that the petition filed by Class 1 railroads for a continuance of temporary rate increases on bituminous coal granted on Oct. 19, 1937, be denied. The increases, amounting to 15c. per ton in the West and 10c. per ton in the East, are to expire Dec. 31 next.

"Bituminous coal is selling," Mr. Carson pointed out, "for less today than in 1926, but it costs more to transport it now than then. Where you paid $1 to the railroads for transporting coal in 1926, today you must pay $1.06. Freight rates on bituminous coal are up; commodity prices are down. Production of bituminous coal today is less than 77 per cent of what it was in 1926. For freight rates to be appreciably increased in the face of fallen production of this necessity of life is contrary to all sound principles of economics. Bituminous-coal consumers are being driven to the use of other fuels because of existing high freights on the commodity.

"In their petition," Mr. Carson continues, "the railroads make the loss of traffic, with incident loss of revenue, the sole basis for their request that the increases be continued. We believe it is a fair conclusion to state that the petition shows that the temporary increases on bituminous coal which the railroads now want made permanent have hurt rather than helped them. The excessive charges the roads are making for transporting bituminous coal have brought only diminishing returns. The railroads need more traffic. It is an economic certainty that they cannot increase their coal traffic by maintaining high freight rates.

Renews Petition for Rate Quiz

"The office of Consumers' Counsel filed a formal petition in this proceeding more than a year ago asking the Interstate Commerce Commission to initiate a general investigation of the bituminous-coal freight-rate structure. Consumers' Counsel now renews that petition and requests the Commission to take prompt action to remedy the inequitable rate situation that is stifling the bituminous-coal industry and penalizing bituminous-coal consumers as well as working contrary to the best interests of the carriers."

The National Coal Association, in its petition, said: "Probably no other industry in the country is in such a deplorable and hopeless financial condition today as is the bituminous-coal industry. The Commission may with propriety note the serious changes for the worse that have taken place in the condition of the coal industry, which at the time of the submission of Ex Parte 123 (the general request for a 15 per cent rate increase) was already in a finan-

cial condition far worse than that of the carriers. Conditions have been growing steadily worse. The price structure contemplated by the Bituminous Coal Commission act has not become operative and there is no indication that it will or can become operative in the reasonably near future. Coal prices are at a lower point than at any time in the immediate past and the trend is still downward."

The Western Pennsylvania Traffic Bureau and the Traffic Bureau of Nashville, Tenn., also have urged the I.C.C. to reject the roads' request for an indefinite extension of the increases.

On the other hand, the Northwestern Retail Coal Dealers' Association, of Minneapolis, Minn., informed the Commission on Sept. 12 that it had no serious objection to a temporary continuance of increased rates. The Northwestern group represents retailers in North Dakota, South Dakota, Nebraska and northwestern Wisconsin, as well as Minnesota.

Harlan County Operators Sign Union Pact

An agreement auguring labor peace in Harlan County, Kentucky, was signed on Aug. 27 at Cincinnati, Ohio, by counsel for the United Mine Workers and the Harlan County Coal Operators' Association. It provides for a seven-hour day and five-day week, a basic rate of pay of $5.60 per day, improvement of working conditions and the standard check-off, and is effective from Sept. 1 until March 31 next. It abolishes company unions. It also was agreed that the Harlan County Operators' Association should affiliate itself with the operators' associations of the Appalachian field and meet in New York City on March 14, 1939, to negotiate a new Appalachian agreement.

The Harlan agreement, which must be ratified by the membership of District 19, U.M.W., calls for the union and the operators to form a pool to arrange reemployment of all men allegedly discharged in violation of the Wagner Labor Relations Act before any new employees are taken on. Union attorneys estimated that more than 13,000 miners were affected by the new pact, which confirmed a contract tentatively drawn up at a private conference a week earlier at Tate Springs, Tenn.

George Ward, secretary of the operators' association, in commenting on the agreement, said: "The operators are entering into this contract with good faith and are going to cooperate with union officials to the end that everybody will be satisfied."

A report in connection with the signing of the pact to the effect that the National Labor Relations Board had consented to dismiss finally all charges of violation of the Wagner act against sixteen coal companies as part of the agreement caused William Green, president, American Federation of Labor, and former secretary-treasurer, U.M.W., to let loose an outburst attacking the agreement. Mr. Green announced in Atlantic City, N. J., where the A.F.L. executive council was in session, that he would bring suit against the N.L.R.B. and the Committee for Industrial Organization to break the contract on the ground that the closed-shop agreement in the pact was a conspiracy to violate the Labor Relations Act because it kept out the Progressive Miners. The A.F.L. executive council later demanded a Congressional investigation into charges that the U.M.W., abetted by operators and Federal and State officials, had establish a reign of terror to exclude the A.F.L. from the coal fields of West Virginia, Illinois and Kansas.

Charles E. Lawall

Lawall Acting Head of W.V.U.

Pending selection of a permanent president to succeed C. S. Boucher, recently resigned, the board of governors of West Virginia University, Morgantown, W. Va., late in August appointed Charles E. Lawall, director of the School of Mines, as acting president. He began his new duties on Sept. 1, retaining his old position. He has been with the university for seventeen years. In announcing the appointment, Arthur B. Koontz, president of the board, said that Mr. Lawall has demonstrated his ability as an administrator by the efficient way he has handled his department.

Hayden Tops Safety Meet

Top honors among Class A teams were captured by men from the Hayden Coal Co., Haybro, Colo., in a State-wide safety contest held Aug. 26 in the municipal auditorium, Denver. Second honors went to the Public Service Co. of Denver; tied for third and fourth were the Gates Rubber Co. No. 1, Robinson No. 4 mine local, United Mine Workers, and the Colorado Fuel & Iron Corporation team from Farr.

In the Class B test, first place was won by the Clayton-Morrison Coal Co. team. Denver Public Service Co. team took the women's event; Oak Creek United Mine Workers' local No. 6078 was second, and the Hayden Coal Co., third. The chief judges were D. J. Parker, U. S. Bureau of Mines, Salt Lake City, Utah, and Prof. W. D. Plank, Lafayette College, Easton, Pa.

Joint Coal Meeting to Cover Wide Range of Topics

A program covering a wide variety of subjects will mark the joint coal meeting of the Coal Division, A.I.M.E.; Fuels Division, A.S.M.E., and the Western Society of Engineers in cooperation with the Chicago sections of A.I.M.E. and A.S.M.E., Illinois Mining Institute and Indiana Mining Institute. The meeting will be held Oct. 13-15 at the Palmer House, Chicago. Besides inspection trips to the plants of the Northern Illinois Coal Corporation, Inland Steel Co., Goodman Mfg. Co. and Fisk Station, the following papers will be read:

"The Bureau of Mines Experimental Coal Hydrogenation Plant," A. C. Fieldner and H. H. Storch, U. S. Bureau of Mines; "Influence of Mechanization on Location of Coal Production in Illinois," Paul Weir; "Fundamentals of Combustion in Small Underfeed Stokers," C. A. Barnes, Battelle Memorial Institute; "Iowa Coal as a Domestic Stoker Fuel," Prof. M. P. Cleghorn, Iowa State Colleege; "Factory Testing of Propeller Mine Fans," Raymond Mancha, Jeffrey Mfg. Co.

"Use of Low-Grade Coals in Modern Steam-Generating Equipment," Ollison Craig, Riley Stoker Corporation; "Panel Discussion on Coal Purchasing": Viewpoint of Preparation, J. B. Morrow, Pittsburgh Coal Co.; Viewpoint of Purchasing Agent, T. W. Harris, Jr., E. I. duPont de Nemours & Co.; Viewpoint of Coal Sales, B. R. Gebhart, Chicago, Wilmington & Franklin Coal Co.; Viewpoint of Purchasing for a Municipality, T. Jeffords, Detroit; "Mechanical Mining at Consolidated Coal Co.," G. Stuart Jenkins, general superintendent, Consolidated Coal Co.; "Material Handling in Coal-Preparation Plants," Nelson L. Davis, Link-Belt Co.; "Haulage in Strip-Coal Pits," Albert L. Toenges, U. S. Bureau of Mines, Pittsburgh, Pa.

"Safety Practices of the Koppers Coal Co.," L. C. Campbell, general superintendent, Koppers Coal Co.; "Recent Trends in Rock-Dust Practice," H. P. Greenwald, U. S. Bureau of Mines, Pittsburgh, Pa.; "Organized Safety in the Anthracite Field," Clyde G. Brehm, Susquehanna Collieries Co.; "Coal for Metallurgical-Furnace Firing," W. R. Bean, Whiting Corporation; "Ash Handling," J. J. Peterson, Chicago Tunnel System.

At the banquet in the evening of the third day, H. N. Eavenson, president, Clover Splint Coal Co., and former president, A.I.M.E., will be the speaker, and Dr. W. L. Abbott, former president, Western Society of Engineers and A.S.M.E., will be toastmaster.

Brazil Gets Norton Washery

As the first step in a program designed to make Brazil independent of foreign coal, largely received from Germany and Great Britain, the Consorcio Administrador de Emprezas de Mineracao has let a contract to the McNally-Pittsburg Mfg. Corporation for a complete washing plant for the Sao Jeronymo mine, about 700 miles south and west of Rio de Janeiro. The plant measures up to the best cleaning installations in the United States and is featured by a McNally-Norton automa-

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tic washery with a capacity of 100-tons per hour, as well as by rather extensive facilities in the crushing section.

The coal to be treated contains in its raw state about 64 per cent ash, which can be reduced to 29 per cent with a recovery of about 70 per cent. The operation is the largest in Brazil at the present time. Steel and machinery for the new plant will be built at the Pittsburg (Kan.) shops of McNally-Pittsburg, and will be shipped from New Orleans to Porto Alegre, Rio Grande do Sul. The installation is expected to open a market for additional American-built plants.

—◈—

Miners to Contribute Cash So Mines Can Resume

An unemployment relief plan whereby three large anthracite collieries, long idle, may be reopened and 500 miners put back to work in Shenandoah, Pa., was proposed on Sept. 1 by Weston Dodson & Co. The plan contemplates expenditure of $400,000 to clean up, rehabilitate and electrify the mines, part of the capital to be supplied by the company and some advanced through local banks by former employees. The company also has offered to contribute its $500,000 Weston breaker for the use of the mines and would serve as selling agent.

The miners voted to accept the proposal to the extent of $50,000, which would be repaid at the rate of $5 each pay day, twice a month.

—◈—

New Preparation Facilities

Fifth Vein Coal Co., Harrisburg, Ill.: Contract closed with McNally-Pittsburg Mfg. Corporation for conveying and loading equipment for new slope mine with a capacity of 1,000 tons of No. 5 coal per hour. The installation supplements the present Sahara Coal Co. tipple and washing plant with additional screening, crushing and loading facilities to take care of the additional tonnage and load an additional stoker size.

Midwest Smokeless Fuel Co., Millstadt, Ill.: Contract closed with Jeffrey Mfg. Co. for complete tipple and washing plant with special facilities for truck loading. The capacity is 350 tons per hour, all of which may be crushed to minus 6 in. and run through the washing plant. The washery will be equipped with two 6-ft.-wide three-compartment Jeffrey Baum jigs. Washed and sized coal will be distributed to loading booms and also to bins by special multi-compartment conveyors with proportioning gates for loading all sizes in a variety of mixtures. Coal loaded on trucks will be rescreened on Jeffrey-Traylor vibrators. Plant construction will be along modern lines, using continuous sash areas for lighting and ventilation.

Volpe Coal Co., Butler Colliery, Pittston, Pa.: Contract closed with Finch Mfg. Co. for 12-ft. Menzies cone separator with feed capacity of 158 tons per hour for cleaning egg and stove sizes; also for 5-ft. Menzies cone separator with feed capacity of 30 tons per hour for cleaning barley size; to be completed about Oct. 1.

Chemists Throw New Light on Oxidation, Mine Fires and Hydrogenation

By R. DAWSON HALL
Engineering Editor, Coal Age

NEW VISTAS in the application of chemistry to coal problems were opened by members of the American Chemical Society at a meeting of the division of gas and fuel chemistry at Milwaukee, Wis., Sept. 6. Among the themes developed at this session—part of the 96th meeting of the society—were:

- *Mine bacteria remove carbon monoxide and hydrogen.*
- *Mine fires may smoulder, though carbon monoxide be absent. Low oxygen aids elimination of carbon monoxide.*
- *Oxidation with alkaline reagents produces oxalic and aromatic acids.*
- *The degree of oxidation can be determined by comparing the volatile content of an anthracite with that of fresh anthracite.*
- *Low-volatile (high-rank) coals do not oxidize as readily as high-volatile (low-rank) coals.*
- *Rank can be determined by measuring the permanganate oxidation of coals.*
- *Hydrogenation gives highest yield with high-volatile A-group coals.*
- *Some fusain will submit to hydrogenation.*

With anthracites direct from the mine face, coals which have the higher volatile content develop the most heat in combustion. Anthracites oxidized by weathering or heating, however, increase their volatile content, but have less, not greater, heating value on combustion. The added volatile content is inert; the original volatile content was an excellent combustible. Thus the heating value is an indication of the freshness or of the oxidation of the anthracite sample and is a measure of the degree of weathering, declared G. S. Scott, assistant chemist, Explosives Division, U. S. Bureau of Mines, speaking also for G. W. Jones and H. M. Cooper, also of the Bureau.

In general it has been found that the equation for anthracites direct from the face is: (1) B.t.u. $= 14\,767 + 79\ V - 166.8\ A$, where V = volatile matter per cent and A ash per cent, both by weight. The average deviation from this formula is ± 19.6 B.t.u. In 98 per cent of the anthracites the deviation is less than 200 B.t.u. Breaker anthracites follow a different, though similar, equation because sometimes coal will be carried to the breaker which has been more or less weathered or oxidized. The equation (2) B.t.u. $= 14{,}840 + 72.7\ V - 168A$ has been found to represent the samples taken, but with these 96.3 per cent are less than 200 B.t.u. from the figures given by the equation.

When anthracite is oxidized over long periods, the first equation proves still more unsuited to the oxidized product. Thus when heated at 350 deg. C. for 92 hours, oxygen in one of the cases cited was raised 89.22 grams per kilogram, volatile matter (dry basis) from 4.6 to 22.9 per cent and ash from 21.4 to 31.9 per cent, while the B.t.u. declined from 11,460 to 7,140. By the formula for a fresh anthracite of a volatile matter and ash the same as that of the artificially weathered anthracite, the heating value would be 11,257 B.t.u., but that value was actually 4,117 B.t.u. lower, for the impoverished condition of the coal was due to oxidation, not to less complete anthracitization.

Correct Conclusions Reached

In all, 1,008 samples were taken in making the survey. Bank-coal samples were found which had B.t.u. values well below those calculated for the ash and volatile-matter content of fresh anthracite. Chestnut had a 490 and barley 1,090 B.t.u. deficiency. As much as 38 per cent volatile matter has been developed in anthracite by heating and oxidation. This method of analysis gives an unerring way of determining if an anthracite is natural or weathered.

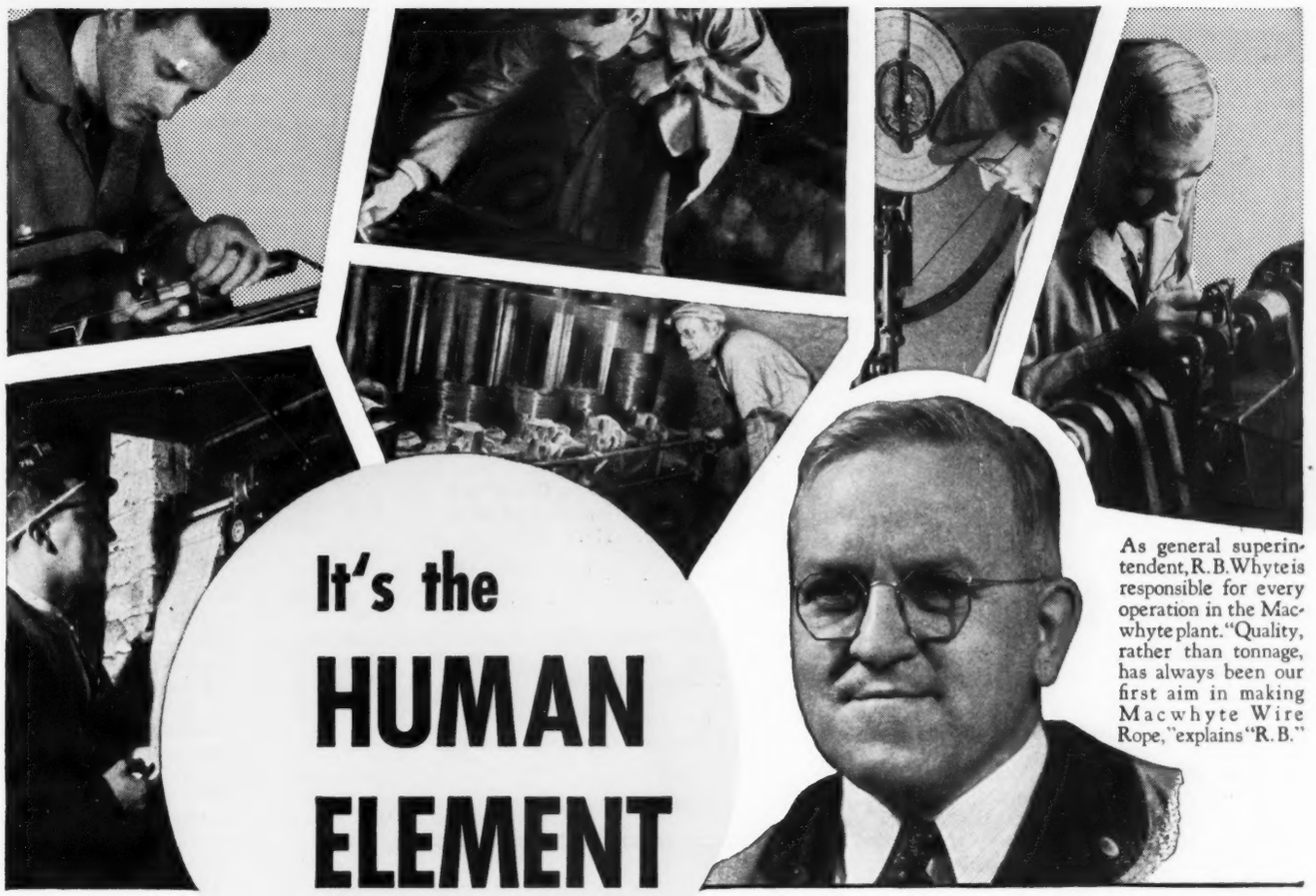
Low-volatile coals, asserted L. D. Schmidt, associate chemist of the Bureau, speaking for himself and J. L. Elder, junior chemist, do not oxidize as fast as high-volatile coals. Based on rate of oxidation in air at the end of the first day, whether figured by oxygen consumed by per cent of weight of dry coal per day, or by oxygen consumed per square meter of surface area per day, or by rate of oxidation in air when coal has consumed oxygen up to one per cent of its weight, Johnston Lower Kittanning, Majestic Pond Creek, Bruceton Pittsburgh and Closplint High Splint coals are in the order named, with the Johnstown coal having the lower oxidation value. If the rate of oxidation in air when the coal has consumed 1 per cent of its weight based on grams of oxygen per square foot of surface area per day is taken, the position of the Johnstown and Pond Creek coals is reversed, but the difference is small. If all the bases are averaged, High Splint oxidizes 66 per cent faster than Bruceton Pittsburgh coal, while Pond Creek and Johnstown Lower Kittanning coals show rates 9 and 16 per cent slower respectively.

Where X is the quantity consumed in the oxidation reaction in per cent by weight of coal, T is the time in the oxi-

Reed Heads Division

Frank H. Reed, chief chemist, Geochemical Section, Illinois Geological Survey, was chosen as chairman of the Division of Gas and Fuel Chemistry, American Chemical Society, at its meeting in Milwaukee, Wis., last month. He succeeds Dr. H. H. Lowry, Carnegie Institute of Technology.

H. C. Hottel, professor of chemistry, Massachusetts Institute of Technology, is vice-chairman of the division. Gilbert Thiessen, Koppers Co., is secretary-treasurer. R. E. Gilmore, Canadian Bureau of Mines, and O. O. Malleis, Bituminous Coal Producers' Board for District No. 8, were named to the executive committee.



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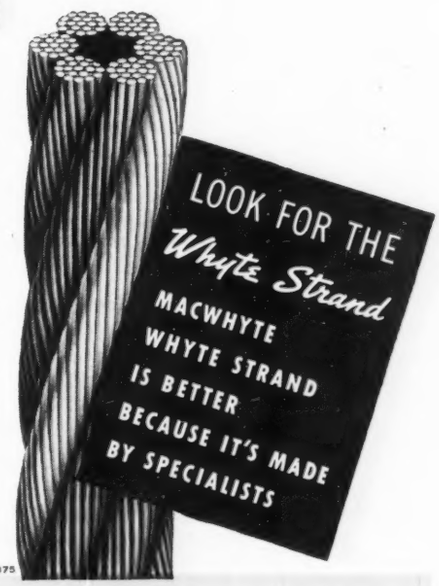

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THE WIRE ROPE WITH THE INTERNAL LUBRICATION

dation apparatus expressed in days and c and b are constants $X = cT^b$. For these tests, coal was oxidized in drums maintained at constant temperature while rotated slowly, half filled with crushed coal, so that the rotation would expose each piece of coal to the same atmosphere periodically and permit the coal to be kept at constant temperature throughout its mass. The drums have exteriorly enameled jackets full of rock-wool insulation except for a narrow band which is bare and receives heat from a gas flame. Means are provided for maintaining the oxygen concentration at about 19.5 per cent, as compared with 20.93 per cent in the natural atmosphere. The atmosphere in the drum is changed every 52 minutes. The lower the rank of the coal the more rapidly it oxidizes, asserted Dr. Schmidt.

Further studies with new refinements and standardization have shown that the method of potassium permanganate oxidation for determining the rank of coal places them in about the same rank as in the A.S.T.M. tentative classification, stated H. L. Olin, University of Iowa, for himself, P. L. Conrad, M. Krouse and R. E. Whitson. Tests of 51 coals covering the entire range from North Dakota lignites to Pennsylvania anthracites proved the similarity of the two methods of rank determination. Particle size was adopted at 60x100 mesh; the coal was first brought into contact with hot pyridine in a beaker for 30 minutes, so as to swell and prevent it from packing in the extraction thimble before transference to the thimble of the Soxhlet apparatus. The freshly extracted sample was washed once with pyridine and three successive times with acetone and dried for six hours at room temperature in a desiccator under high vacuum. High permanganate numbers correspond to a low rank of coal. No attempt has been made to correlate these numbers with coking quality.

While he had endeavored to get perfectly unweathered coal in every case, Dr. Olin was not sure he had succeeded in so doing. Sample containers invariably were sealed at the place of collection by tire tape, but an inert atmosphere was not provided. Three- or four-inch lumps were requested. With No. 6 Illinois coal he had found wide variations, which he ascribed to mutually remote geographical origins.

Time Influences Caking

Twenty-four to 28 hours was found to make wide variations in caking quality, remarked Dr. F. H. Reed, Illinois Geological Survey. If, interjected another chemist, large coal was selected, that in itself caused the petrographical choice of material to be of a specific class and not representative of the whole coal. The more friable coal might well have a different permanganate number suggestive of a different rank. Dr. Olin agreed that the determinations were open to this error. It was also suggested that instead of using the pyridine extraction, the whole coal be used in obtaining permanganate numbers.

Coals, cokes and pitches when oxidized, at least with oxidizing reagents, produce, besides such simple compounds as water, carbon monoxide and carbon dioxide, more complicated compounds which may well have commercial values.

These coals, cokes and pitches, remarked H. C. Howard in his joint paper with R. C. Smith and R. C. Tomarelli, Carnegie Institute of Technology, yield significant quantities of organic acids when subjected to controlled oxidation with oxidizing reagents such as alkaline permanganate and nitric acid. Small quantities of aromatic acids also had been isolated from oxidization products formed by the action of air, at elevated temperatures and pressures, upon suspensions of coal in aqueous alkali.

At temperatures from 100 to 250 deg. C., using aqueous alkalis and oxygen partial pressures from 115 to 350 lb., Dr. Howard and his assistants have oxidized Illinois No. 6 coal, Pittsburgh, High Splint, Pocahontas No. 3, anthracite, 500-deg., 700-deg. and high-temperature coke, graphite and pitch. High-temperature coke and graphite are imperfectly oxidized under these conditions, 50 to 60 per cent of the carbon appearing as carbon dioxide, with smaller quantities in organic acids, which are obtained in insignificant quantity from graphite, because mellitic acid is formed, and this has been found to decompose under the conditions of this oxidation. It required about five times as long to oxidize a 50-gram sample to a given state as it did to oxidize one a fifth as large under the same conditions. Arguing that this showed that because of the low oxygen partial pressure and the low solubility of oxygen, this reaction occurred only where the gas met the liquid, packing material was introduced and the oxidation was speeded thereby.

Experiments were made with nineteen catalysts, but only copper sulphate and cobalt sulphate increased the reaction rate and these acted mostly in the later stages of the extraction, when oxidation was limping. Copper sulphate is undesirable for this reason and because it breaks up the soluble acids to carbon dioxide and water. Under proper conditions, declared Dr. Howard, about 50 per cent of bituminous coal and anthracite can be converted to water-soluble organic acids; the rest of the carbon appears as carbon dioxide. Of the carbon appearing in the organic acids, about a fourth is oxalic acid and the remainder aromatic acids of a composition that averages that of a benzine tricarboxylic acid. Thirty to 40 grams of aromatic acids are actually recovered by oxidation from 100 grams of Edenborn Pittsburgh coal. More appears to be formed, but some probably is lost in recovery. In this trimellitic acid, the 1,2,4 benzine tricarboxylic acid predominates. Less than one gram of terephthalic acid has been isolated per 100 grams of coal.

Coal Oxidized in Bomb

A 1-liter all-nickel bomb, similar to those constructed for hydrogenation, was used for oxidizing the coal. This was heated externally by an electric furnace and agitated by oscillation about 30 deg. above and below the horizontal on a transverse axis. Fifty grams of the material to be oxidized was ground to —200 mesh and suspended in a solution of 335 grams of potassium hydrozide in 350 cc. of water. With material of higher carbon content such as graphite, the size of sample had to be reduced. Below 225 deg. C., the reaction time was slow, and most of the tests were made at 225 to 250 deg. At 250 deg., the soluble carbon acids other than carbon dioxide were unstable; hence for their recovery 200 deg. was preferable.

That bacteria may cause carbon monoxide and hydrogen to disappear as fast as they are generated by a smoldering mine fire was the statement of G. S. Scott, assistant chemist, Explosives Division, U. S. Bureau of Mines, speaking for himself and G. W. Jones, chemist. In an investigation of combustible gases and explosions in underground chambers, manholes and conduits, such as are used by electric companies, gases containing hydrogen and carbon monoxide on passing through certain soils—especially those containing organic and sewage materials —were found to lose part or all of their hydrogen and carbon monoxide, presumably because of the presence of microorganisms. Bacteria found in the water and sludge from certain manholes consume both carbon monoxide and hydrogen and may eliminate these gases from manufactured gas in 10 to 30 days, depending on their rate of propagation.

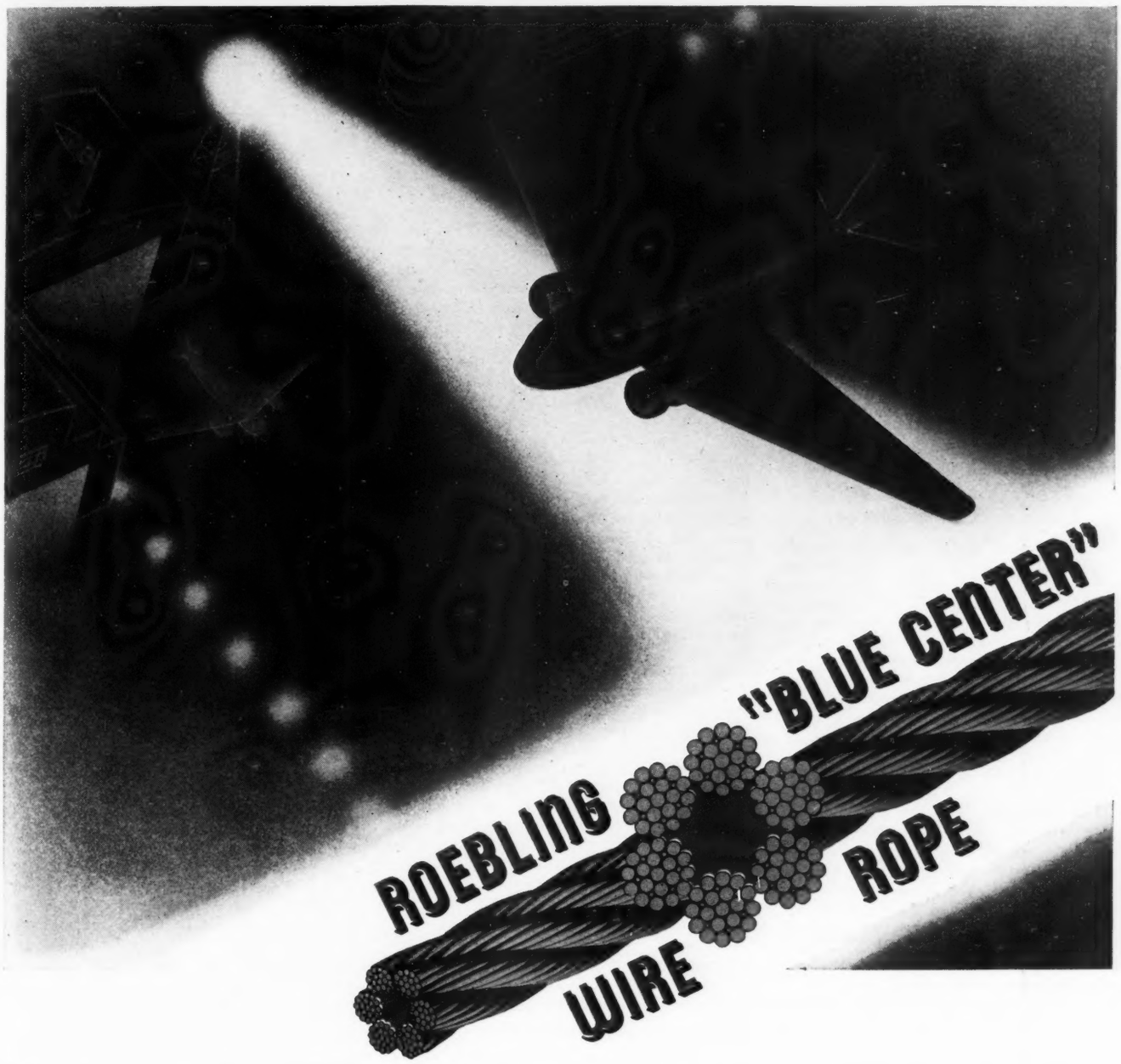
In a sealed anthracite mine fire area comprising some 6,000 cu.ft. of space, the carbon-monoxide content was rather high two days after sealing, but rapidly dropped and disappeared eighteen days thereafter. True, there was some leakage which might account for some of the loss. As anthracite will emit carbon monoxide at temperatures above 150 deg. C., the anthracite or its ash might have removed the monoxide at temperatures below 150 deg. C., but bacteria appeared likely to have been the causative agent for its removal, if such bacteria were present in the open space, water, decaying timber or coal. Stale manure and decaying timber may provide such bacteria.

Ivon Graham, in England, has shown that wetted shavings from old mine props produce a residual gas free of any traces

Coming Meetings

- West Virginia Coal Mining Institute: annual meeting, Oct 7, Charleston, W. Va.
- National Safety Council: Silver Jubilee Congress, Oct. 10-14, Stevens Hotel, Chicago.
- Coal Producers' Association of Illinois: annual meeting, Oct. 11, Springfield, Ill.
- Coal Division, A.I.M.E.; Fuel Division, A.S.M.E., and Western Society of Engineers: joint meeting, Oct. 13-15, Palmer House, Chicago.
- Illinois Coal Mining Institute: 46th annual meeting, Oct. 21, Hotel Abraham Lincoln, Springfield, Ill.
- Missouri Minerals Industry Conference: Oct. 21 and 22, Missouri School of Mines and Metallurgy, Rolla, Mo.
- Coal Conference: Nov. 9-10, West Virginia University, Morgantown, W. Va.
- New River Coal Operators' Association: annual meeting, Dec. 13, Mountainair Hotel, Mount Hope, W. Va.
- American Institute of Mining and Metallurgical Engineers: annual meeting, Feb. 13-16, 1939, 29 West 39th St., New York City.

POINTING THE WAY TO UTMOST ROPE SAVINGS



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of carbon monoxide, but when zinc chloride is added to kill the bacteria, carbon monoxide is present. However, J. S. Haldane and R. H. Makgill confined dry coal dust in a flask at 104 deg. F. for seventeen days until the oxygen disappeared and carbon monoxide was produced in quantities, increasing steadily as oxygen was absorbed until finally 0.32 per cent was present. In similar tests on wetted coal dust with pure oxygen instead of air, a sample after 20 hours showed 0.36 per cent of monoxide; on the third day, 0.55 per cent; on the fourth day, 0.41 per cent, and after fourteen days no monoxide whatsoever.

They suspected that it had been absorbed by bacterial action, but in another test adding a solution of mercuric chloride, 1 part in 1,000 instead of pure water, they still found the monoxide disappeared, so from these and other tests they concluded that the coal after becoming oxidized, if wet oxidized the monoxide to dioxide. Nevertheless, Drs. Jones and Scott found that the presence of wet coal was not necessary; the microorganisms would eliminate the carbon monoxide and hydrogen, which would be almost completely absorbed before the oxygen content of the atmosphere was reduced to zero.

Time vs. Gas Percentage

A mixture of rotted wood, toadstools, funguses and manure (materials likely to be present in a coal mine) were stirred together in distilled water and placed in reaction vessels in contact with an atmosphere from oxidation of anthracite at elevated temperatures. The carbon monoxide percentage of 2.7 was reduced in eleven days to zero and remained zero for three more days. Hydrogen dropped in eleven days from 3.3 per cent to zero with a like absence thereafter.

Decanted organic matter in a vessel was placed in contact with a gas mixture made by passing air through incandescent anthracite. In ten days the hydrogen had disappeared, but after seven days more the carbon monoxide was still almost unchanged, but in another 34 days the monoxide also had disappeared. No methane was formed in these tests, though Franz Fischer, R. Lieske and K. Winzer, in Germany, found that certain bacteria cause hydrogen and carbon monoxide to react in the absence of oxygen to form methane and have proposed to use these microorganisms to remove carbon monoxide from illuminating gas. Such bacteria do not seem to be present in this coal. The test shows that the carbon monoxide begins to disappear rapidly only when the oxygen content has dropped to about 5 per cent.

In experiments, said Dr. Scott, some waters of the anthracite mine discussed were more active than others in reducing carbon monoxide and hydrogen percentages, but all the mine waters reduced the hydrogen percentage markedly and all but one the content of carbon monoxide, and even this water had a slight effect in that direction. A gangway water from an anthracite mine contained enough bacteria to remove 1.7 volumes of carbon monoxide per volume of water in twenty days.

To the Agde-Damn dilatometer and the Davis plastometer has been added the plastometer of K. Gieseler, which has been modified by the Bureau of Mines, said R. E. Brewer, associate chemical engineer of the Bureau, speaking for himself and his junior scientific aid, J. E. Triff. A new loading device which gives a standard loading compression is provided, and a heating bath consisting of 750 grams of Wood's metal and 680 grams of "half-and-half" solder, with a melting point of 138 deg. C. replaces Gieseler's equimolecular mixture of sodium and potassium, with its attendant danger of explosions.

Coal is sized to 0 to 35-mesh (Tyler sieve). Size 0 to 60-mesh tended to froth and swell out of the retort with erratic indications resulting. The modified Gieseler plastometer method has the advantage of covering both preplastic and plastic temperature ranges, of measuring the small degree of fluidity of low-volatile coals and of indicating relative coal fluidities. "Alleged arguments against the imperfections of any one method largely disappear when one considers the proper limitations to which this method must be confined in general use," declared Dr. Brewer.

Pilot-plant tests, asserted G. B. Zimmerman, Universal Oil Products Co., speaking for Gustav Egloff, W. E. Lemen and J. C. Morrell, have evaluated the cracking characteristics of coal byproducts, including high- and low-temperature tars, high-temperature creosote oil, lignite tar and its fractions and coal-oil carbonization distillates. From these liquids have been obtained gasoline, with low-boiling phenols and cresols, gas and fuel oil or coke residues. The olefine-containing gases are raw material for synthetic hydrocarbons or high-grade polymer gasoline; the coke may be converted to electrode carbon, and valuable tar acids or cresylic-acid fractions obtained.

Though refractory, the raw materials yield more gasoline than their specific gravities would indicate. The gasolines are of satisfactory quality and have higher heats of combustion per unit volume than those from petroleum. More gas is produced than in petroleum cracking. Though of lower molecular weight, the gas can produce useful concentrations of higher olefines by fractionation.

Yields of Primary Oils From Several Canadian Coals and One British

Designation of Coal		U. S. Gallons per 2000 lb.	
Location	Rank	Dry and Ash-Free Basis	Basis of Ash as Charged and Capacity Moisture as Mined
Crowsnest, B. C.	Med.-Vol. Bit.	149	142
Vancouver Is., B. C.	High-Vol. Bit. A	161	145
Durham, Eng.	High-Vol. Bit. A.	172	161
Sydney, N. S.	High-Vol. Bit. A.	185	173
Micola, B. C.	High-Vol. Bit. B.	178	152
Saunders, Alta.	High-Vol. Bit. C.	128	108
Drumheller, Alta.	Sub-Bit. B.	150	114
Edmonton, Alta.	Sub-Bit. C.	138	95
Bienfait, Sask.	Lignite	136	83

Same Treatment Given Coals

All the coals hydrogenated at the Fuel Research Laboratories of the Canadian Bureau of Mines have been subjected to a common treatment, declared T. E. Warren, for himself and associates, K. W. Bowles and R. E. Gilmore. No attempt has yet been made to ascertain the most favorable treatment for any one of the coals. The best mean yield of oil is 77.2 per cent, which is that of Sydney (N.S.) coal of Carboniferous Age and grouped with high-volatile A coals, and the lowest, 53.3 per cent, is that of Saunders (Alta.) of Cretaceous Age and grouped with high-volatile C coals. Coals of higher fixed carbon than the Sydney coal, but still of high-volatile A grouping, give lower yields; 71.5 per cent that of Durham, England, of Carboniferous Age, used at the Billingham hydrogenation plant, and 66.8 per cent that of Vancouver (B. C.) of Upper Cretaceous Age. Apparently there is a preferable value for fixed carbon from which the yields decline in either direction. None of the coals tested have been low-volatile.

Rank of coal was found to have a fairly consistent influence on yield, although one of the coals was exceptional, continued Dr. Warren. Bitumious high-volatile A and B groups gave the highest oil yields. Effects of composition of ash and geological age, although largely obscured by the effect of rank, probably have little effect, if any, on yields. There is an apparent relationship between nitrogen content of coal and degree of liquefaction.

No fundamental changes have been made in the hydrogenation plant of the U. S. Bureau of Mines, though many minor changes have been introduced to aid smooth running and efficiency. As yet, studies have been confined to the Bruceton coal. The conditions in liquid-phase hydrogenation that will give a maximum yield have been determined broadly for this coal, asserted L. L. Hirst, physical chemist, who spoke for himself, C. O. Hawk, G. C. Sprunk, P. L. Golden, L. I. Pinkel, R. L. Boyer, J. F. Shaeffer, R. H. Kallenberger, H. A. Hamilton and H. H. Storch. These conditions are: Temperature, 420 to 440 deg. C., with the corresponding contact-time range

Sales of Mechanical Stokers Show Sharp Rise

Sales of mechanical stokers in July last totaled 9,061 units, according to statistics furnished the U. S. Bureau of the Census by 112 manufacturers (Class 1, 64; Class 2, 37; Class 3, 39; Class 4, 30; Class 5, 13). This compares with sales of 6,088 units in the preceding month and 7,579 in July, 1937. Sales by classes in July last were: residential (under 61 lb. of coal per hour), 8,075 (bituminous, 6,756; anthracite, 1,319); small apartment-house and small commercial heating jobs (61 to 100 lb. per hour), 379; apartment-house and general small commercial heating jobs (101 to 300 lb. per hour), 371; large commercial and small high-pressure steam plants (301 to 1,200 lb. per hour), 174; high-pressure industrial steam plants (more than 1,200 lb. per hour), 62.

from 2.75 to 1.75 hours (yields above 440 deg. C. are still insufficiently indicated); pressures, 200 to 300 atmospheres; circulation of hydrogen, about 100 cu.ft. (measured at 20 deg. C. and 760 mm. pressure) per hour of hydrogen.

Under these conditions a yield of about 73 per cent of "middle oil" (containing 20 per cent boiling in the gasoline range and 80 per cent boiling below 330 deg. C.), and 12 to 15 per cent of hydrogen gases (methane to butane) is obtained in a single pass through the converter. The 12 to 15 per cent loss consists of 6 to 8 per cent unreacted carbonaceous material (fusain and opaque attritus, which hydrogenate with difficulty) and 6 to 7 per cent oxygen, nitrogen and sulphur which hydrogenate to water, ammonia and hydrogen sulphide. The middle oil contains 15 to 18 per cent tar acids and 3 to 5 per cent of tar bases and the remaining neutral oil contains 6 to 8 per cent olefines, 67 to 70 per cent aromatics and 22 to 27 per cent saturated hydrocarbons. Canadian yields are based on the ash-and-moisture-free coal weights alone; the United States yields are based on these plus hydrogen used.

Fusain Hydrogenation

Some fusain can be hydrogenated was the gist of a paper presented by C. H. Fisher, associate organic chemist, Bureau of Mines, for himself, G. C. Sprunk, Abner Eisner, Loyal Clarke and H. H. Storch. Analyzing seven United States fusains, it was found that the ratio of carbon to hydrogen ran between 25.2 and 33.1, whereas the parent coals had ratios running from 14.5 to 19.3. Dry, ash-free fusain had from 7.3 to 18.9 per cent volatile matter, whereas the parent coal values ran from 19.3 to 42.4 per cent. The fusains were liquefied to an astonishing extent (15 to 27 per cent) in view of the widely held view that fusain is almost completely resistant to hydrogenation. The one fusain that offered most resistance to hydrogenation had a high carbon-hydrogen ratio and very low content of volatile matter.

From results thus far available, it appears that the relative ease of liquefaction of fusains can be predicted better from the carbon-hydrogen ratio and hydrogen content than from the volatile-matter percentage. Liquefaction significantly, under the conditions used, proceeded readily to a certain point and then became difficult, suggesting that fusain is composed of two main constituents differing greatly in their amenability to hydrogenation. The insoluble residues from hydrogenation of fusains have carbon-hydrogen ratios running from 19.3 to 37.7, so it would seem they are almost pure fusinite, to which coal constituent C. A. Seyler (Great Britain) gives a carbon-hydrogen ratio of 43. Under transmitted light, fusains show about 10 per cent of translucent matter, but the residues exhibit only traces. This fact is in agreement with the view that the translucent matter has been hydrogenated and that the opaque matter remains. Volatile matter in hydrogenation residues is roughly proportional to their ash content, owing probably to the presence of inorganic volatile matter. Several residues have more volatile matter than the fusains from which they are formed.

Personal Notes

O. F. ALLEN, foreman at No. 86 mine of the Consolidation Coal Co., has been made superintendent at No. 25 mine, Clarksburg, W. Va., vice George O. Tarleton, promoted.

N. L. BARGER has been appointed superintendent at the New Century mine of the New Century Coal Co., Ragland, W. Va.

J. B. BENSON has been made superintendent at the Midland mine of the Greenbrier Fire Creek Coal Co., Charmco, W. Va.

BIRCH BROOKS, mining engineer with the Saxton Coal Mining Co., Terre Haute, Ind., for the last ten years, has been promoted to superintendent, vice JAMES S. ANDERSON.

COLVIN BURK has been advanced to the post of mining engineer by the Saxton Coal Mining Co., Terre Haute, Ind., vice Birch Brooks, promoted.

G. HERBERT CLENDENIN, sales manager, Rocky Mountain Fuel Co., Denver, Colo., has been elected a member of Bituminous Coal Producers' Board 16, vice JOHN R. LAWSON, resigned.

WILL H. COGHILL, Roseville, Ill., has been appointed supervising engineer at the Bureau of Mines Southern Experiment Station, Tuscaloosa, Ala. With the appointment goes promotion to the post of principal engineer, non-metals division. B. W. GANDRUD, former supervising engineer, will remain on duty, but, because of ill health, has asked to be relieved of administrative duties.

JAMES M. DANIEL has been made sales manager of the Blue Diamond Sales Co., with headquarters in Cincinnati, Ohio. He formerly was sales manager of the Stearns Coal Sales Co., where he began as a salesman, subsequently becoming secretary to the general manager.

R. C. DENNY has been appointed superintendent at Nos. 204-7 mines of the Consolidation Coal Co., Letcher County, Kentucky, vice B. H. PURSER, promoted.

JAMES A. DOWNEY, JR., safety engineer for the Sloss-Sheffield Steel & Iron Co., has been elected president of the Birmingham (Ala.) Safety Engineers Club, vice FRANK E. CASH, U. S. Bureau of Mines.

JOHN B. GALLAGHER, international auditor, United Mine Workers, was named by Governor Earle of Pennsylvania on Sept. 1 to succeed the late Michael J. Hartneady on the commission investigating the explosion of June 2 at the Butler colliery of the Volpe Coal Co., Pittston Township, Pa.

JAMES L. GILLEY has been appointed general mine foreman at Nos. 204-7 mines of the Consolidation Coal Co., Letcher County, Kentucky, vice R. C. DENNY, promoted.

GEORGE HIGGINBOTHAM, assistant general manager of the West Virginia division of the Consolidation Coal Co., has been transferred to the company's department of safety and efficiency.

H. L. KEENEY has been made foreman at the Whipple mine of the New River Co., Scarbro, W. Va.

F. P. KERR has been appointed assistant division superintendent at the Carswell,

HERE THEY COME . . . 40 S-D "Automatics", rolling on S-D "Floater" Ball Bearing Wheels, to the tipple. In 2 minutes, all of them will be dumped and on their way back to the mine.

JUST THIS — You Can Dump 8800 S-D "AUTOMATICS" in 440 Minutes . . . .

Perhaps you read the story published recently in one of the mining industries' leading trade magazines, telling you that "1136 Rotary Dump cars of coal were dumped in 440 Minutes" in a certain mine . . . that "literally every minute of the entire shift was used for dumping." A fine record for Rotaries (and we build them too), but, by way of comparison, we are telling you that in 440 Minutes, you can dump 8800 S-D "AUTOMATICS" of equal capacity. Over seven times faster than Rotaries, and without any expensive dumping equipment. This of course does not mean that a mine could load 8800 cars in 440 minutes. The comparison is made simply to illustrate the dumping speed of S-D "Automatics."

Isn't this evidence enough to convince you of the unusual speed of S-D "Automatics" . . . that obviously, fewer cars are required, with less investment and less operating costs, yet, with greater production possibilities? In addition, you don't even have to buy S-D "Automatics." We know what they will do for you at cutting hauling and dumping costs, and we therefore, do not hesitate offering you a liberal leasing plan. Write us at once . . . let an S-D representative given you the complete story.

SANFORD-DAY IRON WORKS, Inc., Knoxville, Tenn., U. S. A.

Mine Cars, All Types — Trailers — Sheaves — Wheels

Keystone and Maitland mines of the Koppers Coal Co., McDowell County, West Virginia.

J. L. KOYSTAL has been named superintendent at the Keystone mine of the Koppers Coal Co., Keystone, W. Va.

E. G. LAW has been made foreman at the Fire Creek mine of the Susanna Pocahontas Coal Co., War, W. Va.

T. J. O'BRIEN, president, Kemmerer Coal Co., was reelected president of the Southern Wyoming Coal Operators' Association at its annual meeting. W. J. THOMPSON, vice-president, Colony Coal Co., was renamed vice-president, and L. W. MITCHELL was continued as secretary-treasurer.

E. H. OHLINGER has been appointed foreman at Brooke Nos. 1 and 2 mines of the Clear Creek Coal Co., Clearco, W. Va.

H. B. PAINTER has been made foreman at Wright No. 2 mine of the Grandview Coal Co., McCreery, W. Va.

GEORGE PARK has been appointed general inspector of mines for the Woodward Iron Co., Woodward Ala. He formerly was associate mine inspector for the State, resigning last year, after serving for more than a decade.

B. H. PURSER, superintendent, Mine No. 204, Consolidation Coal Co., Jenkins, Ky., has been appointed to succeed B. M. ROGERS as assistant to the division general manager of the Millers Creek division of the company, Van Lear, Ky.

H. A. QUENON has been made foreman at the Keystone mine of the Koppers Coal Co., Keystone, W. Va.

J. T. REYNOLDS, superintendent of Mines Nos. 1, 3 and 4, Lorado Coal Mining Co., Lorado, W. Va., has resigned, effective Sept. 1.

B. H. SHREWSBERRY has been appointed foreman at the Norfolk mine of the Pocahontas Fuel Co., Maybeury, W. Va.

E. E. STEPHENS has been made superintendent at Powellton No. 4 mine of the Koppers Coal Co., Kimberly, W. Va.

GEORGE O. TARLETON has been appointed assistant general manager of the West Virginia division of the Consolidation Coal Co., vice George Higginbotham, transferred. Mr. Tarleton, who has been with the company for the last twenty years, has been superintendent at the No. 25 mine, Clarksburg, W. Va., for the last four years.

ROBERT V. WHITE was elected president of the Lehigh Coal & Navigation Co. at a meeting of the board of managers in Philadelphia, Pa., on Sept. 8. He succeeds SAMUEL D. WARRINER, who had been president pro tem since the resignation of Joseph H. Nuelle to become president of the Delaware & Hudson Railroad, effective May 15. Mr. White will retire as a partner in the brokerage firm of Jackson & Curtis. He has been a member of the board of managers and executive committee of L. C. & N. since March.

SAMUEL J. WILLIS, division superintendent, Springfield district, Peabody Coal Co., has been made division superintendent of the Midland district with headquarters at Taylorville, Ill. He took over his new duties Sept. 1, succeeding CHARLES McREAKEN, who has been seriously ill since March.

Court Ban on Revealing Production Costs Not to Delay Setting of Prices

- **Federal Court of Appeals grant temporary injunction restraining Coal Commission from making public individual basic cost data of operators following denial of request in District Court.**
- **Commission rescinds order permitting inspection of production costs data.**
- **Hearing on proposed prices gets under way at Denver.**
- **Intrastate commerce in Colorado coal declared subject to coal act.**
- **Arkansas "anthracite" declared to be bituminous and subject to regulation under coal act.**
- **Five captive producers exempted from coal act provisions.**
- **Six Iowa companies seek exemption.**

WASHINGTON, D. C., Sept. 16—Operators opposed to allowing individual production cost data to be made public in connection with fixing minimum soft-coal prices under the Guffey Coal Control Act won a temporary victory when Justice Miller, in the Federal Court of Appeals, granted a temporary injunction on Wednesday to prevent disclosure of such data by the National Bituminous Coal Commission. The injunction was obtained by 22 coal companies in West Virginia, Pennsylvania, Utah and Wyoming, which had recourse to the appellate court when Justice Cox, in Federal District Court, denied their request six days previous. A similar request by the Mallory Coal Co. and several other companies was dismissed by the Court of Appeals on Aug. 1 on jurisdictional grounds (*Coal Age*, September, p. 60). The Commission had announced on Aug. 31 that production cost data would be opened for inspection at Denver, Colo., Sept. 10—deferred five days by consent of the Commission following Justice Cox's decision—and in this city on Sept. 20. When the injunction was granted, however, the Commission rescinded its order allowing interested parties to inspect the figures.

Chairman Tetlow of the Commission stated at Denver on Thursday that the temporary stay would cause no delay in the ultimate establishment of prices. Hearings in regard to proposed minimum prices and marketing rules and regulations submitted by district boards Nos. 16-20, 22 and 23 (covering the Far West and Alaska) were started in Denver on Wednesday, with five of the six Commissioners sitting. Evidence is to be adduced relating to kinds, qualities and sizes of coals produced; classification; price variations as to mines; consuming market areas and values as to uses and seasonal demand.

Following a hearing held before a trial examiner at Fort Smith, Ark., the Commission on Aug. 31 declared all coal produced in the Spadra field of Arkansas (composed of Washington, Crawford, Sebastian, Scott, Madison, Franklin, Logan, Johnson, Pope, Yell and Conway counties) to be bituminous and subject to the provisions of the bituminous-coal act. It specifically decided that the output of the Sunshine Anthracite Coal Co., Diamond Anthracite Coal Co. and D. A. McKinney Coal Co., all of Clarksville, Ark., was bituminous and therefore affected, although the Sunshine company has brought action in Federal District Court at Little Rock seeking exemption (*Coal Age*, August, 1938, p. 62).

Partial exemption from the act was granted by the Commission, however, to five companies in other areas on the ground that coal produced at certain of their operations is consumed by them and does not enter the commercial market. The companies and production excepted are: Inland Steel Co.—on coal produced at Wheelwright, Ky.; Norfolk & Western Ry.—Howard, Pond Creek and Vulcan collieries; Pittsburgh Steel Co.—coal produced at its mines in Fayette, Greene and Westmoreland counties, Pennsylvania; Pennsylvania Electric Co.—coal produced in four mines in Clearfield, Somerset, Centre and Indiana counties, Pennsylvania, and the Ross Clay Products Co.'s mines near Ulrichville, Ohio.

Hearings were set for Sept. 26 at Des Moines on petitions for exemption by these Iowa companies: Riggen Coal Co., Harvey; Bradley Brothers Coal Co., Knoxville; Beck Coal & Mining Co., Des Moines; Liter Coal Co., Carlisle; Mahaska Coal Co., Oskaloosa, and Diamond Block Coal Co., Pella.

Permissible Plates Issued

Five approvals of permissible equipment were issued by the U. S. Bureau of Mines in August, as follows:

Sullivan Machinery Co.: Type 9-X track-mounted coal-cutting machine; 50-hp. motor, 415 volts, a.c.; Approval 350-A; Aug. 9.

Sullivan Machinery Co.: Type WK-29 "Mine Air" compressor; 30-hp. motor, 250 volts, d.c.; Approval 351; Aug. 20.

Jeffrey Mfg. Co.: Type 29-U track-mounted coal-cutting machine; 50- and 25-hp. motors, 220-440 volts, a.c.; Approvals 352 and 352A; Aug. 24.

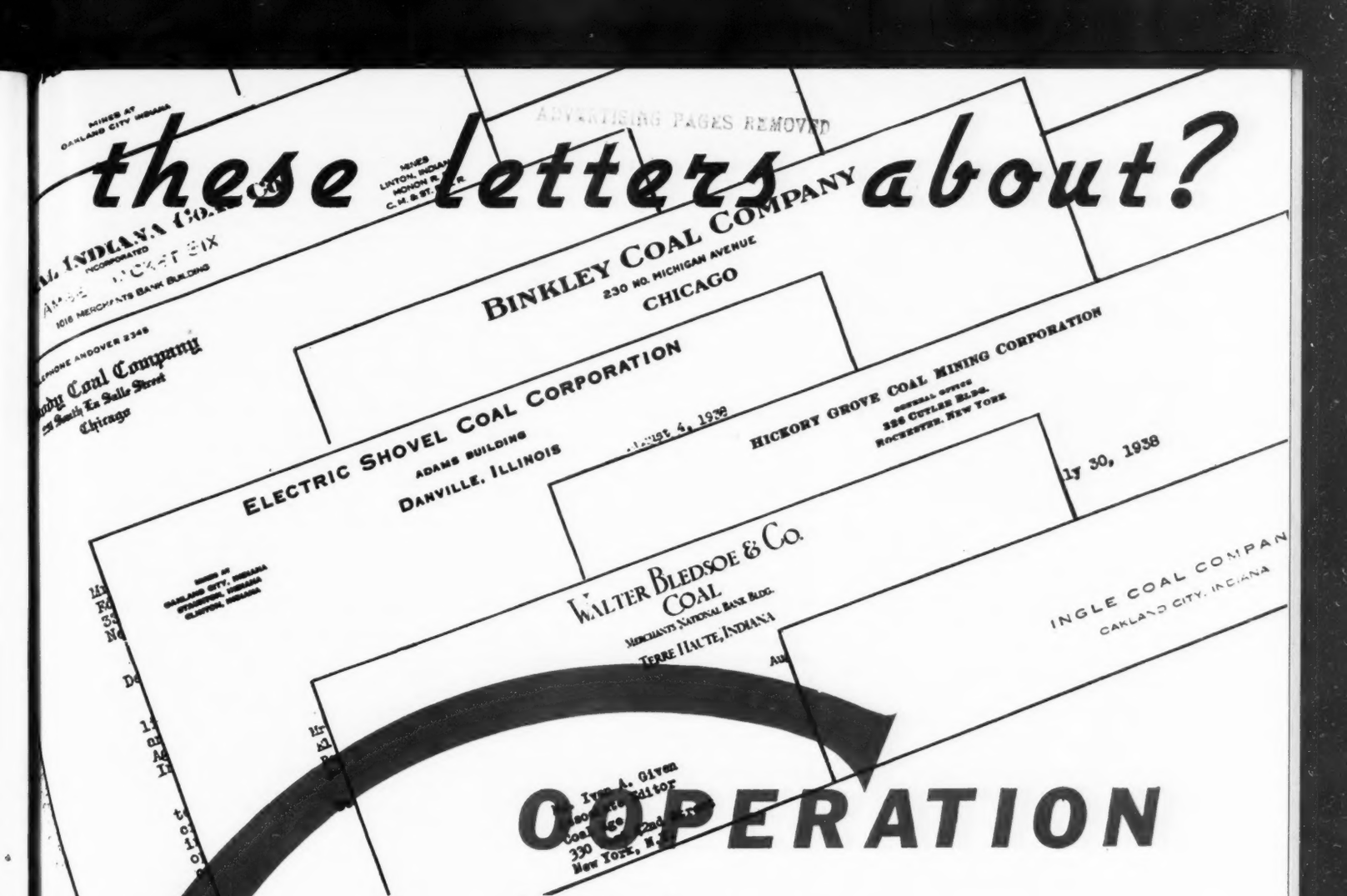
Jeffrey Mfg. Co.: Type 35-BC shortwall mining machine; 35-hp. motor, 250-500 volts, d.c.; Approvals 353 and 353A; Aug. 26.

Mine Safety Appliances Co.: M.S.A. methane tester; Approval 806; Aug. 26.

A.I. Men on Anthracite Tour

In conformity with its policy of cooperating closely with the business men of the anthracite region, Anthracite Industries, Inc., assigned three members of its staff to accompany the Scranton (Pa.) Chamber of Commerce on its fourth annual anthracite tour, which started Sept. 19. Including about 125 business men, the tour was to include Ottawa and Montreal, Canada; Utica, Glens Falls, Albany and Poughkeepsie, N. Y.; and Newark

(*Turn to page* 88)



OPERATION

from Indiana's operators to make the Indiana number the greatest that Coal Age has ever published

Meet the men of Indiana's mining industry and you will meet a group of the industry's most progressive and able operators. Visit their properties and you will see modern low cost mining at its best — the kind of mining that has brought them into foremost rank in the high tonnages produced per man day.

If you can not visit these operations in person as the Coal Age staff has done, then December Coal Age will take you through them, pointing out all that is best in modern mining, haulage, preparation, etc.

The advertising pages will not only introduce your products, their performance, and your Indiana installations to these men, but to all worthwhile operators in the country as well. Advertising forms close November 5th.

18th Annual Model Mining Number
DECEMBER

COAL AGE
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COAL AGE

and Hoboken, N. J., with luncheons and dinners at each of the stops, sponsored by local chambers of commerce and retail coal merchants. At each of the meetings the Anthracite Industries representatives, J. M. Crosby, C. W. Little and R. J. Hill, were to address the assembled guests and outline the purposes of the merchandising organization and describe its activities.

Geologists to Meet in London

The eighteenth session of the International Geological Congress is to be held in London, England, in 1940, the first to be held there since 1888. Subjects already proposed for consideration include the geology of coal seams, but suggestions for additional subjects for discussion are invited. A number of excursions to places of geological and general scientific interest, both before and after the congress, have been provisionally selected.

Anthracite at World's Fair

An energetic citizens' movement to insure effective representation of anthracite at the New York World's Fair next year, started in Wilkes-Barre, Pa., is rapidly gaining momentum throughout the hard-coal producing region. The movement, which is formally known as the Anthracite Boosters' Exhibit Committee, was initiated because of the belief that the Keystone State's proposed exhibit at the fair would be inadequate in so far as it dealt with hard coal.

Unusual Gas Outburst Blamed For Butler Blast

A commission of five State mine inspectors assigned to investigate the explosion at the Butler colliery of the Volpe Coal Co., Pittston Township, Pa., which took ten lives on June 2, reported that they found no criminal negligence. They attributed the disaster to an unusual and sudden outburst of gas. The commission was composed of Inspectors Edwin C. Curtis, Henry R. Owens, Joseph C. Hines, Frank Kettle and Frank A. Gleason, all in charge of Luzerne County territories. Although the inspectors' report is dated June 17, it was not made public until Sept. 9. A coroner's jury handed down a similar report on Aug. 3 (*Coal Age*, September, P. 65).

"It is the opinion of the commission," said the inspectors, "that the accident was caused by a sudden outburst of gas, liberated by a large cave, the gas pushing out upon the men before they were aware of its presence. An accumulation of gas under the circumstances such as found in this case is very unusual, particularly in the locality in which this mine is situated. In the opinion of the commission, no person, either official or workman, can be held responsible for this accident. The amount of gas ordinarily emitted was of such little consequence that the most prudent man could not reasonably be expected to anticipate an accumulation of such volume in such a short period of time as was experienced in this case."

Appended to the report were the following recommendations "to prevent a similar disaster":

"1. That official supervision of the working places in robbing sections be extended beyond that specifically required by law. Frequent examinations for gas should be made during each shift.

"2. Each miner in charge of a working place should be impressed with the necessity of examining such place before the firing of a blast and before commencing work and after the firing of each blast.

"3. That frequent tests be made for gas, by means of an approved methane detector, in the main return and in the section returns leading from territories in which pillar work is carried on.

"4. That too much emphasis cannot be placed on the necessity for caution. This applies with equal force to the workmen and the officials. Those engaged in dangerous occupations will find the law a poor substitute for common sense and caution."

Safety Themes for Study

Accidents from all causes will be put under the microscope at Chicago on Oct. 10-14, when more than ten thousand persons are expected to assemble in the Stevens Hotel for the National Safety Council's silver jubilee safety congress and exposition. Besides more than 130 exhibits, both commercial and contributive, including displays and working demonstrations, a number of papers bearing on safety in various industries will be presented, including the following coal topics: "Ventilation Methods and Installations in Coal Mining," Raymond Mancha, manager, ventilation division, Jeffrey Mfg. Co.; "Proven Methods of Educating Miners in Safety," George Martinson, safety director, Pickands, Mather & Co.; Eugene McAuliffe, president, Union Pacific Coal Co., and M. L. Workman, superintendent, Koppers Coal Co.; "Mechanized Mines vs. Non-Mechanized Mines—Their Relation to Safety," Paul Weir, Chicago.

Purser Honored by Friends

B. H. Purser, superintendent, Mine No. 204, Consolidation Coal Co., Jenkins, Ky., was honored early in September with a banquet arranged by more than 70 of his friends, including company officials, preparatory to his departure to succeed B. M. Rogers, assistant to the division general manager of the Millers Creek division, Van Lear, Ky. With J. C. Hunsiker, division store manager, as toastmaster, there were talks by A. D. Sisk, secretary, Big Sandy Mining Institute, and the following fellow employees of the company: W. C. Halbert, personnel manager; Frank Correll, division mine inspector; George Christopher, division coal inspector; Dr. J. E. Standfill, chief surgeon; and E. P. Wolfe, J. D. Snyder, and R. C. Denny, superintendents.

James Gilley, general mine foreman, presented a desk lamp to Mr. Purser in behalf of friends in the organization.

Missouri Minerals Conference

A Missouri Minerals Industry Conference, sponsored by the Missouri School of Mines and Metallurgy and the State Geological Survey, will be held Oct. 21 and 22 at the School of Mines, Rolla, Mo. The

purpose of the meeting, according to Dr. William R. Chedsey, director of the School of Mines, is for the mutual benefit of producers of mineral products and the service institutions supported by the State.

The conference will take the form of the presentation of problems of the various mineral industries by important mineral producers. Dr. H. A. Buehler, Missouri Geological Survey; S. M. Shelton, supervising engineer, Mississippi Valley Experiment Station, U. S. Bureau of Mines, and Dr. Chedsey will outline the services now available to Missouri mineral producers. By such interchange of thought, said Dr. Chedsey, each group will have a better knowledge of the needs of the mineral industry and the service by State institutions that will be best adapted to obtaining the most sought results.

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Progressives Ask Federal Aid In Feud With U.M.W.

A Congressional investigation of violence alleged to have been directed against organizers of the Progressive Mine Workers was asked Sept. 14 in a resolution adopted at the union's Illinois district convention, held at Gillespie. The resolution charged that the United Mine Workers "instituted a reign of terror" in West Virginia, Kansas and Illinois coal fields to thwart the Progressives' national organizing campaign. President Joe Ozanic had previously told the convention that mobs had tried to break up Progressive union meetings in West Virginia.

The convention also urged enactment of a law requiring strip-mine operators in Illinois to replace soil after the removal of coal. A campaign for the legislation was adopted whereby Representatives and Senators would be requested to revive and approve the original soil-replacement bill which bogged down in the last General Assembly.

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Name Committee to Aid Coal

The Chamber of Commerce of Bluefield, W. Va., has set up a special coal industry committee whose function it is to exert every effort within its power to aid the bituminous coal industry.

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Industrial Notes

LINCOLN ELECTRIC CO., Cleveland, Ohio, announces that J. W. Meriam, for the last 24 years vice-president and secretary, has retired from those posts but will continue as a director. A. F. Davis, vice-president, was made secretary.

Thomas E. Millsop, president, Weirton Steel Co., has been elected to the executive committee of the NATIONAL STEEL CORPORATION. Other members of the committee are George M. Humphrey, president, Hanna Iron Ore Co., chairman; George R. Fink, president, Great Lakes Steel Corporation, and Ernest T. Weir, chairman of the board, Weirton Steel Co.

ROBBINS & MYERS, INC., Springfield, Ohio, has appointed as sales representative in Detroit, Mich., the John E. Livingstone Co., 7310 Woodward Ave.

Decries Progressive Gains In West Virginia

Richard Bow, secretary of Local 340, United Mine Workers, at Ward, W. Va., headquarters of the Kelley's Creek Colliery Co., denied, in a statement on Aug. 31, that the organization had voted to surrender its charter in favor of the Progressive Miners, as alleged by Joseph Ozanic, president of the latter union. "The Progressives claim 700 members here," said Mr. Bow, "and the most we ever had was around 600. To the best of my knowledge, there are about 34 members of the Progressives in this community, and most of them are not employed at the mines. The only member of the local to withdraw was one who was defeated for reelection as checkweighman and went over to the Progressives as an organizer. As long as coal is mined at the Kelley's Creek Colliery Co., the United Mine Workers will be here."

The Progressives also reported that charters had been presented during the week of Aug. 22 to new locals at Eskdale and Sharon, W. Va., asserting that over 51 per cent of the Eskdale local had voted to surrender their U.M.W. charter and reorganize under the Ozanic aegis. The same ratio of 260 Sharon men were reported to have taken similar action.

The Independent Miners' Union, of western Kentucky, said to have a membership of four thousand, has been chartered as District 5, P.M.W., according to an announcement on Sept. 1 by President Ozanic. Five hundred employees of the Wisconsin Steel Co., at Benham, Ky., the only large operation not covered by the contract effected late in August between Harlan operators and the U.M.W., received a Progressive charter on Aug. 30 as Local 402.

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N.C.A. Campaign Renewed

The campaign of the National Coal Association to recover markets lost to competing fuels, launched July 5, showed renewed vigor with the issuance on Sept. 8 of a folder entitled "Why." In eight pages it tells succinctly why those who would sell equipment, goods or services to the bituminous-coal industry should be concerned with its plight, setting forth its difficulties and the methods proposed for their solution.

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New Stoker Data Issued

Two publications of prime interest and value to engineers and salesmen of bituminous coal for underfeed stokers, reporting results of research by Bituminous Coal Research, Inc., were issued during September. One, dealing with fundamentals of combustion in small underfeed stokers, covers sizing, types of coal (coking and free-burning), stoker air control and every other aspect of the subject of combustion. Comprising 80 pages, it has many drawings, graphs and illustrations from photographs.

The second publication, covering performance of several types of bituminous coal in small underfeed stokers, comprises 35 pages, the text being explained by

graphs and charts. Copies may be obtained by addressing Bituminous Coal Research, Inc., 804 Southern Building, Washington, D. C., ordering by full titles: "Technical Report No. 4—Combustion of Bituminous Coal in Small Underfeed Stokers," 50c.; "The Performance of Several Types of Bituminous Coal in Small Underfeed Stokers," 20c.

Letter to the Editor

"I note in the last issue of *Coal Age*," writes E. B. Wagner, electrical engineer, Lehigh Valley Coal Co., Wilkes-Barre, Pa., "an article headed '$900 Saved Annually by D.C. Braking of A.C. Motor.' In reading this article, a statement is made that this method of dynamic braking has been applied in few, if any, other instances in coal mining. I would call your attention to an article by R. W. McNeil in the issue of Jan. 10, 1924, of *Coal Age*, entitled 'Novel Application of Dynamic Braking of Large Slope Hoist.' This article describes a method of dynamic braking which is practically the same as that in the above mentioned article."

Sales Ideas Dramatized

In its "blue coal" dealer cavalcade, entitled "Here's How," the D. L. & W. Coal Co. demonstrates in dramatic form the right and wrong ways to approach an anthracite prospect; the right and wrong ways to make deliveries, and the right and wrong ways to answer telephone inquiries. Opening at the Hotel Statler, Buffalo, N. Y., on Sept. 6, performances were scheduled in each of the fourteen "blue coal" territories, winding up at the Hotel Schroeder, Milwaukee, Wis., on Sept. 23.

The performers include fourteen professionals in both dramatic and comedy skits, presented on a revolving stage. Audiences also are taken "behind the scenes" in a radio studio and shown how the company's "Shadow" program is produced, the broadcast being reproduced by the actors. The performance concludes with a moving picture, "Selling America," topped off by a buffet supper with cold beer.

Joy Opens Engineering Office

J. F. Joy, until recently manager of the mining machinery division of Sullivan Machinery Co., has opened engineering offices at 561 Union Trust Building, Pittsburgh, Pa. This business comprises three divisions of activity: a mining division working with coal-producing companies in the mechanical production of coal by the coordination of existing equipment to specific conditions and the design of special equipment for conditions where none suitable is available; a manufacturers' division cooperating with mining-machinery manufacturers in improvement of present products and the development of additional products; a contractors' division to meet specific problems arising out of difficult tunneling and excavating projects.

Patent for Coal Pipe Line

A novel method of shipping coal from the mines to the point of use by pumping it through pipes has been developed by the Standard Oil Co., it has been revealed through the grant of a patent (No. 2,128,913) to Robert E. Burk, of Cleveland, Ohio. In utilizing the new method the coal is ground to a powder at the mine, then stirred in water to which a small quantity of soap has been added. The soap keeps the powdered coal in suspension, preventing it from settling out.

In the liquid form the coal is pumped through the pipe lines to the point of use. Arrived at its destination, a small quantity of lime is added, which precipitates the soap and causes the coal to settle. After the water is drained off, the powdered coal is compressed into bricks for burning. Instead of making the coal liquid with water, it may be suspended in oil and pumped to its destination, and burned in this form without precipitating and forming it into bricks.

Lincoln Awards Made

The jury of award of the James F. Lincoln Arc Welding Foundation, Cleveland, Ohio, has made 382 awards ranging from $101.75 for honorable mention to $13,941.33, the grand award, in its $200,000 prize offer for papers on the application of welding to manufacture and construction of new equipment (*Coal Age*, March, 1937, p. 129). In the processing machinery division, covering mining equipment, George T. Dexter, Puget Sound Sheet Metal Works, received first award

of $712.28 for his paper, "Redesign of Mounting Base for Diesel-Driven Mining Pump"; second ($508) went to Eugene A. Balsley and Charles A. Schneider, engineers, Link-Belt Co., for their paper, "Arc-Welded Design of Wash Box"; an award of $101.75 went to Charles S. Roach, Fairmont Machinery Co., for his paper, "Field Welding of Coal Tipples."

To Reopen St. Clair Mine

After an idleness of many years, the St. Clair mine, in the Eagle section of West Virginia, is to be reopened and operated by the Eagle Collieries Co., which has leased the property of more than 300 acres. The new company is headed by W. H. Sopher, under whose direction there will be extensive improvements, including construction of a loading conveyor and ice breaker to facilitate shipments by river.

Obituary Notes

LIEUT. COL. CHARLES WALTER VILLIERS, 65, general manager of Canadian Collieries (Dunsmuir), Ltd., Nanaimo, B. C., died Sept. 3 in the Royal Jubilee Hospital, Victoria, B. C., after three months' illness following an accident.

JAMES MARTIN MULL, 50, director of statistics for the National Bituminous Coal Commission in the Indianapolis (Ind.) district, died April 27 at his home at Ligonier, Pa. He had been employed more than twenty years by the E. W. Mudge interests in Pittsburgh, Pa., subsequently acting as general superintendent of coal mines for the Woodward Iron Co., Woodward, Ala. He had been connected with the Bituminous Commission since its inception.

Trade Literature

BEARINGS — Norma-Hoffmann Bearings Corporation, Stamford, Conn. Folder briefly outlines precautions taken to safeguard the quality of Norma bearings between manufacture and actual application.

BELT IDLERS AND MAT RESCREENS—Jeffrey Mfg. Co., Columbus, Ohio. Folder 689 illustrates and describes a variety of idlers for numerous applications. Bulletin 692 is devoted to mat rescreens, giving sizes, weights and test results.

CENTRIFUGAL PUMPS — Allis-Chalmers Mfg. Co., Milwaukee, Wis. (Bulletin 1653, 28 pp.). Tells about the company's line of SSUnit close-coupled centrifugal pumps covering a range of 10 g.p.m. against 10-ft. head to 1,600 g.p.m. against 120-ft. head and for lower capacities up to 300-ft. head. Included are capacity tables showing ratings obtainable and recommended motor sizes and speeds for various ratings, as well as dimension sheets and useful data in figuring pump installations.

COLD COATINGS—Amercoat Sales Agency, Huntington Park, Calif. Sixteen-page booklet gives description and uses of, as well as the application procedure necessary for, the various types of Amercoat sprayable plastic coating for concrete, metal and wood surfaces.

DRILL AND COMPRESSOR LUBRICANTS—E. F. Houghton & Co., Philadelphia, Pa. Four-page folder describes advantages of STA-PUT' lubricants and oils for use in the mining industry.

DRILLING AND LOADING EQUIPMENT—Jeffrey Mfg. Co., Columbus, Ohio. Bulletin 688 (12 pp.) describes and pictures drilling units, with details of construction and operation. Catalog 685 (20 pp.) shows eight types of loading equipment designed for use in various systems of mining and many different operating conditions.

DUST CONTROL—W. W. Sly Mfg. Co., Cleveland, Ohio. Bulletin 90 (24 pp.) gives a résumé of Sly cloth-type filters, their application to many dust-control problems and other general information on dust-control equipment and installations. Bulletin 91 (4 pp.) covers the "Centri-Merge" wet dust collector.

ELEVATING CONVEYORS—Goodman Mfg. Co., Chicago (Bulletin C-3710, 12 pp.). Gives detailed description, with specifications, of a complete line of units designed as a convenient, rapid method of transferring coal or rock short distances while elevating it from one level to another.

ENDLESS BELT—Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., Passaic, N. J. (Bulletin 6869). Describes construction and applications of Condor Whipcord endless belt, with illustrations of various types of installations.

EXCAVATOR BUCKETS—Wellman Engineering Co., Cleveland, Ohio. Catalog, consisting of a series of bulletins, explains characteristics and uses of a large variety of buckets.

VACUUM CLEANING—Connecticut Blower Co., Hartford, Conn. (Bulletin 63, 4 pp.). Describes the company's industrial cleaning system, citing need for it and its accomplishments.

VALVES—Crane Co., Chicago. Bulletin AD-1264 gives the inside story of Crane plug disk globe and angle valves, with table listing essential characteristics of each member of the plug disk family. Bulletin AD-1276 covers the whole check-valve field in word, picture and diagram.

WELDING ELECTRODES — Harnischfeger Corporation, Milwaukee, Wis. (Bulletin R-5, 28 pp.). Gives complete and specialized information and data on each of the many "Smoothare" units.

Coal-Mine Fatality Rate Again Recedes

Accidents at coal mines of the United States caused the deaths of 48 bituminous and 12 anthracite miners in July last, according to reports furnished the U. S. Bureau of Mines by State mine inspectors. With a production of 23,460,000 tons, the death rate among bituminous miners was 2.05 per million tons, compared with 3.31 in the corresponding month of last year.

The anthracite fatality rate in July last was 4.67, based on an output of 2,571,000 tons, as against 4.43 in July a year ago.

For the two industries combined, the death rate in July last was 2.30, compared with 3.40 in July, 1937.

Fatalities during July last, by causes and States, as well as comparable rates for the first seven months of 1937 and 1938, by causes, are shown below.

COAL-MINE FATALITIES IN THE UNITED STATES IN JULY, 1938, BY CAUSES AND STATES

	Underground								Open-cut and Surface				
State	Falls of Roof	Falls of Face	Haulage	Electricity	Suffocation	Other Causes	Total Underground	Persons Falling Down Shafts	Mine Cars	Electricity	Other Causes	Total Surface	Grand Total
Alabama	7	..	..	..	..	..	7	...	..	..	..	..	7
Arkansas	1	..	..	..	..	..	1	...	..	..	..	..	1
Colorado	..	..	..	1	..	..	1	...	..	..	..	..	1
Illinois	1	..	1	..	..	..	2	...	..	..	..	..	2
Iowa	1	..	..	..	..	2	3	...	..	..	..	..	3
Kentucky	3	..	2	..	..	..	5	...	..	..	1	1	6
Ohio	1	..	..	..	..	..	1	...	..	1	..	1	2
Pennsylvania (bit.)	2	..	2	..	..	1	5	...	..	..	..	..	5
Tennessee	2	..	..	..	..	..	2	...	..	..	..	..	2
Virginia	1	..	..	1	..	..	2	...	..	..	..	..	2
West Virginia	8	1	6	..	..	..	15	...	1	..	..	1	16
Wyoming	..	..	1	..	..	..	1	...	..	..	..	..	1
Total (bituminous)	27	1	12	2	...	3	45	...	1	1	1	3	48
Pennsylvania (anthracite)	7	1	..	..	2	1	11	1	...	...	...	...	12
Total	34	2	12	2	2	4	56	1	1	1	1	3	60

FATALITIES AND DEATH RATES AT UNITED STATES COAL MINES, BY CAUSES*

January–July, 1937 and 1938

	Bituminous				Anthracite				Total			
	Number Killed		Killed per Million Tons		Number Killed		Killed per Million Tons		Number Killed		Killed per Million Tons	
	1937	1938	1937	1938	1937	1938	1937	1938	1937	1938	1937	1938
Falls of roof and coal	339	236	1.330	1.352	79	81	2.566	3.042	418	317	1.463	1.575
Haulage	127	71	.498	.407	19	14	.617	.526	146	85	.511	.422
Gas or dust explosions:												
Local	8	13	.031	.074	...	1	.....	.038	8	14	.028	.070
Major	47	60	.184	.344	...	18	.....	.676	47	78	.165	.388
Explosives	28	10	.110	.057	9	7	.292	.263	37	17	.130	.085
Electricity	32	20	.126	.115	2	2	.065	.075	34	22	.119	.109
Machinery	19	10	.075	.057	2	...	.065	.....	21	10	.074	.050
Shaft	11	3	.043	.017	4	3	.130	.113	15	6	.053	.030
Miscellaneous	21	11	.082	.063	10	8	.325	.300	31	19	.109	.094
Stripping or open-cut	13	3	.051	.017	5	8	.163	.300	18	11	.063	.055
Surface	40	17	.157	.097	11	5	.357	.188	51	22	.179	.109
Total	685	454	2.687	2.600	141	147	4.580	5.521	826	601	2.892	2.987

* All figures subject to revision.

REPLACES 2 OILS AND SAVES BEARINGS

ON SHOVEL MOTOR-GENERATOR SET...

• ORDINARILY, shovel operation in stripping required two oils, one for summer and one for winter lubrication of motors and motor generator bearings. A central state operator was having trouble during the spring and fall seasons, when temperatures varied widely, in determining just when to change oil. Each change of season brought a disheartening number of bearing failures.

The Standard Lubrication Engineer told him about Stanoil No. 25, an oil with low pour test that maintains its lubricating quality over a wide range of temperatures.

With Stanoil No. 25 in the bearings the year around, the chief electrician found that he could quit trying to outguess the weather man. Bearing failures stopped, and, in addition, he had one oil less to stock. The slightly higher cost of the oil was more than paid for by saving in bearings and repair costs.

It's almost certain that somewhere in your operation the higher quality in Stanoil will pay its way in reduced maintenance and lower ultimate oil costs. Let a Standard Lubrication Engineer point out some of these places. He'll make this analysis at no cost to you. Call him at the nearest Standard Oil (Indiana) office or write 910 South Michigan Avenue, Chicago, Illinois.

STANOIL

STANDARD OIL COMPANY (INDIANA)

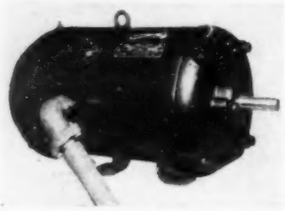
LUBRICATION ENGINEERING *THE RIGHT LUBRICANT • PROPERLY APPLIED TO REDUCE COSTS*

WHAT'S NEW

In Coal-Mining Equipment

PERMISSIBLE MOTORS

A new line of permissible-type d.c. explosion-proof motors is announced by Louis Allis Co., Milwaukee, Wis. These motors, states the manufacturer, have been specially designed to withstand the toughest usage in gaseous mines and to deliver dependable power with a greater margin of safety than ever will be required. In addition to U. S. Bureau of Mines rating as acceptable for the power unit of permissible equipment, the motors also have been approved by the Underwriters' Laboratories for use in all Class 1, Group D explosive atmospheres up to and including Frame No. 774.



Among the outstanding features of the new line are: Small, compact over-all dimensions which make these motors interchangeable with a.c. and d.c. NEMA frame sizes (NEMA dimensions D and shaft sizes), low over-all height, heavily reinforced cast-iron and steel construction, double protected insulation, non-sparking high-tensile aluminum radial-type fan located at the commutator end of the motor and keyed and locked to the shaft, streamline shape.

ROLLER BEARINGS

A complete line of Link-Belt Shafer radial-thrust single- and double-row roller bearings in unmounted form is offered by the Link-Belt Co., Chicago. Features cited by the company include: free rolling action with unimpaired loading capacity, even with shaft deflection or misalignment; elimination of the need for provision for shaft misalignment in bearing housing and mounting; thrust capacity provided by roller and raceway shapes and by the angular position of the curved rollers between curved races; ability to carry radial or thrust loads or any combination of the two with the same full contact area under all conditions of misalignment; and elimination of the possibility of rollers pinching and binding, as well as the need for auxiliary means of taking thrust.

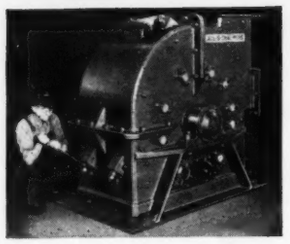
STOKER BREAKER

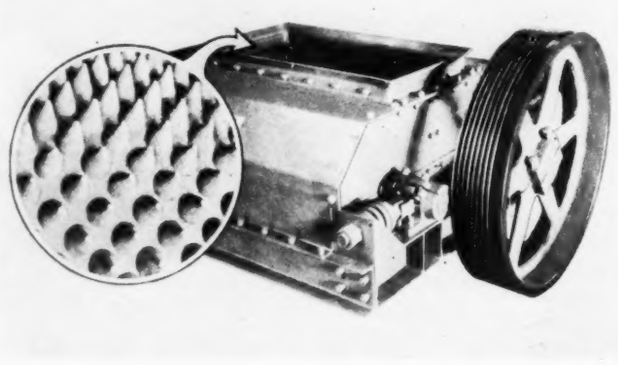
A new breaker for reducing lump coal to stoker sizes has been announced by the McNally-Pittsburg Mfg. Corporation, Chicago. Built in various sizes, the new unit is designed to produce stoker coal from ½- to 1¼-in. with a minimum of fines. Of the double-roll type, both rolls are equipped with large cone-shaped teeth scientifically spaced, it is stated, so that the lumps are properly sized without crushing or grinding. Hence, it is declared, very few fines are produced. The wide spacing of the teeth and the setting of the rolls permits undersized coal to pass through freely. Other features noted by the manufacturer are: safety spring to separate the rolls when tramp iron enters the crusher; driving gears and breaking cones arranged so that one roller cannot get out of mesh with the other; heavy rolls with strong teeth; oversized bearings and gear-tooth faces for long life; and shear pins between flywheel, V-belt and drive shaft. The new stoker-coal breaker is built in all capacities.

MINING AIDS

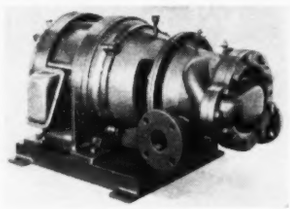
Allis-Chalmers Mfg. Co., Milwaukee, Wis., offers the new Utah electro-magnetic vibrating grizzly feeder, which is a combination of the Utah vibrating feeder and the "Cantilever" grizzly. This combination, according to the company, results in a highly efficient feeder and scalping unit for use ahead of crushers, for separating out fine material for cushioning in loading belt conveyors and other purposes around material-handling plants. Sizes from 18 to 72 in. are available "for any reasonable capacities."

Another Allis-Chalmers development is an improved design of "Pulverator" (hammer mill) in three sizes, supplementing the present line. The pulverizing chambers of the new units are 24, 36 and 48 in. in inside width. Features cited by the company include: welded-steel-plate construction, stress relieved; elimination of bolts in the pulverizing chamber by fastening liners on the outside by means of lugs; rotor of heavy steel disks for flywheel effect, making external flywheels unnecessary; stirrup-type reversible and adjustable manganese-steel hammers with detachable manganese-steel arms; wear-resisting steel grate bars removable and replaceable without disturbing the rotating element; and direct electric motor, Texrope V-belt or flat-belt drive.





The Centrifugal Pump Division of Allis-Chalmers has added a 2½x1½-in. two-stage "SSunit" pump to its line of single-stage units. The two-stage pump, according to the company, is good for heads up to 525 ft. at 3,550 r.p.m., and has an efficient capacity range of 50 to 100 g.p.m. against heads from 300 to 500 ft. The pump is bolted to the motor frame by a splashproof connection piece. Impellers are mounted on the special motor-shaft extension, and the motor bearings also serve as the pump bearings. Motors from 10 to 30 hp. are available in the standard squirrel-cage, splashproof or explosion-proof types.



WELD CLEANER

A new compound, said to reduce cleaning time after welding by 20 to 60 per cent, is announced by Lincoln Electric Co., Cleveland, Ohio. Known as "Spatter Film" and soluble in water, the compound is brushed over the work near the seam or joint and reduces the tendency of spatter to adhere tightly. Thus, its removal is facilitated. A gallon of the compound, it is stated, will cover approximately 50,000 sq.in. It can be removed for painting by wiping it off with a clean cloth, if still wet, or, if dry, by washing with water. "Spatter Film," weighing 8¾ lb. per gallon, is available in quart, gallon and 5-gal. cans, as well as 55-gal. drums.